ANNEXURE A
to the Civil Aviation Technical Standards 92

SEGMENT 1

Part 1	Classification procedures, test methods and criteria relating to explosives of Class 1;
Part 2	Classification procedures, test methods and criteria relating to self-reactive and polymerizing substances of Division 4.1 and organic peroxides of Division 5.2;
Part 3	Classification procedures, test methods and criteria relating to substances or articles of Class 2, Class 3, Class 4, Division 5.1, Class 8 and Class 9;
Part 4	Test methods concerning transport equipment; and
Part 5	Classification procedures, test methods and criteria relating to sectors other than transport.

(7)Except as indicated otherwise, these Technical Standards do not apply to dangerous goods carried by an aircraft where the dangerous goods are:

a) to provide, during flight, medical aid to a patient or to preserve tissues or organs intended for use in transplantation when those dangerous goods:
   1) have been placed on board with the approval of the operator;
   2) form part of the permanent equipment of the aircraft when it has been

   modified for specialized use; providing that:

   1) gas cylinders have been manufactured exclusively for the purpose of containing and transporting that particular gas;
2) equipment containing wet cell batteries is kept and, when necessary, secured in an upright position to prevent spillage of the electrolyte;
3) lithium metal or lithium-ion cells or batteries meet the provisions of Segment 2 and spare lithium batteries are individually protected so as to prevent short circuits when not in use;.
3) to provide, during flight, veterinary aid or a humane killer for an animal;
4) for dropping in connection with agricultural, horticultural, forestry, ice jam control, landslide clearance, pollution control activities or pest management activities;
5) for dropping or triggering in connection with avalanche control activities;
6) to provide, during flight, or related to the flight, aid in connection with search and rescue operations;

7) vehicles carried in aircraft designed or modified for vehicle ferry operations and all of the following requirements are met:
8) authorization has been given by the appropriate authorities of the States concerned, and such authorities have prescribed specific terms and conditions for the particular

operator's operation;

9) adequate ventilation rates are maintained in the aircraft compartment in which the vehicle is carried;

10) vehicles are secured in an upright position;

11) fuel tanks are so filled as to prevent spillage of fuel during loading, unloading and transit; and

(b)required for the propulsion of the means of transport or the operation of its specialized equipment during transport (such as refrigeration units) or that are required in accordance with the operating regulations (such as fire extinguishers)

(c) contained within items of excess baggage being sent as cargo provided that:

(1)the excess baggage has been consigned as cargo by or on behalf of a passenger;

(2)the dangerous goods may only be those that are permitted by and in accordance with 92.01.3 to be carried in checked baggage;

(3)he excess baggage is marked and labelled with the words "Excess baggage consigned as cargo".

(4)data loggers and cargo-tracking devices with installed lithium batteries, attached to or placed in packages, overpacks or unit load devices, provided the following conditions are met:

(a)for a lithium-ion cell, the Watt-hour rating not exceeding 20 Wh;

(b)the data loggers or cargo-tracking devices must be in use or intended for use during transport;

(c)each cell or battery must meet the provisions of Segment 2;

(d)for a lithium-ion battery, the Watt-hour rating not exceeding 20 Wh;

(e)for a lithium metal cell, the lithium content does not exceed 1 g;

(f)for a lithium metal battery, the aggregate lithium content not exceeding 1 g;

(g)the number of data loggers or cargo-tracking devices in or on any package or overpack must be no more than the number required to track or to collect data for the specific consignment;

(h)the data loggers or cargo-tracking devices must be capable of withstanding the shocks and loading normally encountered during transport;

(i)the devices must not be capable of generating a dangerous evolution of heat; and

(j)the devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems.

(8)Provision must be made to stow and secure dangerous goods transported under Segment 1 during take-off and landing and at all other times when deemed necessary by the pilot-in-command.

(9)The dangerous goods must be under the control of trained personnel during the time when they are in use on the aircraft.

(10)Dangerous goods transported under Segment 1 may be carried on a flight made by the same aircraft before or after a flight for the purposes identified above, when it is impracticable to load or unload the dangerous goods immediately before or after the flight, subject to the following conditions:

a) the dangerous goods item must be capable of withstanding the normal conditions of air transport;
b) the dangerous goods item must be appropriately identified (such as by marking or labelling);
c) the dangerous goods item may only be carried with the approval of the operator;
d) the dangerous goods item must be inspected for damage or leakage prior to loading;
e) loading must be supervised by the operator;
f) the pilot-in-command must be notified of the dangerous goods loaded on board the aircraft and their loading location. In the event of a crew change, this information must be passed to the next crew;
g) the dangerous goods must be stowed and secured in the aircraft in a manner that will prevent any movement in flight which would change their orientation;
h) all personnel must be trained commensurate with the functions for which they are responsible;
i) the provisions of 92.01.29 to 41 apply.

(11)Dangerous goods transported under Segment 1 may be carried on flights made by the same aircraft for other purposes (such as training flights and positioning flights prior to or after maintenance), subject to the conditions in Segment 1

12)Unless otherwise permitted by these Technical Standards, no person shall offer or accept dangerous goods for international civil transport by air unless the goods have been properly prepared, packaged, identified, documented and otherwise comply with the applicable requirements.

- Classified
- Documented
- Certificated
- Described
- Packaged
- Marked
- Labelled and

in the conditions for shipment required by these Technical Standards.

(13)Any person carrying out a function prescribed by these Technical Standards on behalf of the consignor or the operator must perform that function in full compliance with the applicable requirements of these Technical Standards.

(14)Dangerous goods shall not be transported by air unless they have been properly accepted, handled and carried in accordance with the requirements established by these Technical Standards.

(15)No person shall represent, label, mark, certify or offer any packaging as being compliant with these Technical Standards unless the packaging has been manufactured, constructed, marked, maintained, reconditioned or repaired in accordance with the applicable requirements.

(16)Dangerous goods shall not be carried, or permitted to be carried, on board an aircraft in checked baggage, carry-on baggage or on a person's body, except where such carriage is specifically permitted in accordance with 92.01.3.

(17)If a person performs a function required by these Technical Standards on behalf of the person who offers the dangerous goods for transport by air or on behalf of the operator, that person must perform that function in accordance with the requirements of these Technical Standards. No person may transport dangerous goods by air unless those goods are accepted, handled and transported in accordance with these Technical Standards. No person may label, mark, certify or offer a packaging as meeting the requirements of these Technical Standards unless that packaging is manufactured, fabricated, marked, maintained, reconditioned or repaired as required by these Technical Standards. No person shall carry dangerous goods or cause dangerous goods to be carried aboard an aircraft in either checked or carry-on baggage or on the person, unless permitted by 92.01.3.

(18)Where the application of a standard is required and there is any conflict between the standard and these Technical Standards, the Technical Standards will always take precedence. The requirements of the standard that do not conflict with these Technical Standards must be applied as specified, including the requirements of any other standard, or part of a standard, referenced within that standard as normative

(19)Any package opened during an inspection must, before being forwarded to the consignee, be restored by qualified persons to a condition that complies with these Technical Standards.

Segment 1 Section 2

(1)Any article or substance which, as presented for transport, is liable to:

- Explode
- Dangerously react
- Produce a flame
- Dangerous evolution of heat
- Dangerous emissions of toxic, corrosive or flammable gases or
- Vapours under conditions normally encountered in transport must not be carried on aircraft under any circumstance.

(2)The provisions of these Technical Standards do not apply to the following:

a) articles and substances which would otherwise be classified as dangerous goods but which are required to be onboard the aircraft in accordance with the pertinent airworthiness requirements and operating regulations or that are authorized by the State of the Operator to meet special requirements;

b) aerosols, alcoholic beverages, perfumes, colognes, liquefied gas lighters and portable electronic devices containing lithium metal or lithium ion cells or batteries provided that the batteries meet the provisions of Table 92.01.3.4.1 carried aboard an aircraft by the operator for use or sale on the aircraft during the flight or series of flights, but excluding non-refillable gas lighters and those lighters liable to leak when exposed to reduced pressure;

c) dry ice intended for use in food and beverage service aboard the aircraft;

d) alcohol-based hand sanitizers and cleaning products carried onboard an aircraft by the operator for use on the aircraft during the flight or series of flights for the purposes of passenger and crew hygiene;

e) electronic devices, such as:

- electronic flight bags,
- personal entertainment devices,
- and credit card readers, containing lithium metal or lithium-ion cells or batteries and spare lithium batteries
- such devices carried aboard an aircraft by the operator for use on the aircraft during the flight or series of flights, provided that the batteries meet the provisions of Table 92.01.03.4.1).
- Spare lithium batteries must be individually protected so as to prevent short circuits when not in use.
- Conditions for the carriage and use of these electronic devices and for the carriage of spare batteries must be provided in the operations manual and/or other appropriate manuals as will enable flight crew, cabin crew and other employees to carry out the functions for which they are responsible.

(3)Unless otherwise authorized by the State of the Operator, articles and substances intended as replacements for those referred to in Segment 2, or articles and substances referred to in Segment 2 which have been removed for replacement, must be:

- transported in accordance with the provisions of these Technical Standards, except that when consigned by operators,
- they may be carried in containers specially designed for their transport, provided such containers are capable of meeting at least the requirements for the packagings specified in these Technical Standards for the items packed in the containers.

(4)Unless otherwise authorized by the State of the Operator, articles and substances

intended as replacements for those referred to in Segment 2 must be transported in accordance with the provisions of these Technical Standards.

(5)Unless otherwise authorized by the State of the Operator, battery-powered devices with installed batteries and spare batteries intended as replacements for those referred to 2.2.1 e) must be transported in accordance with the provisions of these Technical Standards.

(6)In accordance with the Universal Postal Union (UPU) Convention, dangerous goods as defined in these Technical Standards, with the exception of those listed below, are not permitted in mail. Appropriate national authorities should ensure that the provisions are complied with in relation to the transport of dangerous goods by air.

(7)The following dangerous goods may be acceptable in mail for air carriage subject to the provisions of the appropriate national authorities concerned and these Technical Standards:

a) **Patient specimens** as defined in Segment 2; provided that they are classified, packed and marked as required by Segment 2;

b) **Infectious substances** assigned to category B (UN 3373) only, when packed in accordance with the requirements of Packing Instruction 650, and solid carbon dioxide (dry ice) when used as a refrigerant for UN 3373. Where dry ice is used as a refrigerant for UN 3373, all applicable requirements of Packing Instruction 954 must be met. Mail containing dry ice as a refrigerant for UN 3373 must be offered separately to the operator by the designated postal operator so that the operator can comply with all applicable requirements of the Technical Instructions;

c) **Radioactive material** in an excepted package, UN Nos. 2910 and 2911 only, the activity of which does not exceed one-tenth of that listed in Segment 2, Section 7, Table 2-14, and that does not meet the definitions and criteria of classes, other than Class 7, or divisions, as defined in Segment 2. The package must be marked with the name of the shipper and the consignee, the package must be marked “radioactive material – quantities permitted for movement by post” and must bear the radioactive material, excepted package label (Figure 5-33);

d) **Lithium-ion batteries** contained in equipment (UN 3481) meeting the provisions of Section II of Packing Instruction 967.
No more than four cells or two batteries may be mailed in any single package; and

e) **Lithium metal batteries** contained in equipment (UN 3091) meeting the provisions of Section II of Packing Instruction 970. No more than four cells or two batteries may be mailed in any single package.

(8)The procedures of designated postal operators (DPOs) for controlling the introduction of dangerous goods in mail into air transport are subject to review and approval by the Civil Aviation Authority of the State where the mail is accepted.

(9)The DPO must have received specific approval from the Civil Aviation Authority before the DPO can introduce the acceptance of lithium batteries as identified in Segment 2.

(10)Small quantities of dangerous goods, as defined in Segment 3, Section 5, are excepted from certain provisions of these Technical Standards subject to the conditions laid down in that Section

(11)Dangerous goods packed in limited quantities are excepted from certain provisions of these Technical Standards subject to the conditions laid down in Segment 3, Section 4.

(12)The following lamps are not subject to these Technical Standards if they do not contain radioactive material:

a) lamps each containing not more than 1 g of dangerous goods and packaged so that there is not more than 30 g of dangerous goods per package, provided that:
   1) the lamps are certified to a manufacturer's quality management system; and
   2) Each lamp is either individually packed in:
      - inner packagings,
      - separated by dividers,
      - or surrounded with cushioning material to protect the lamps and packed into strong outer packagings meeting the general provisions of Segment 4; and capable of passing a 1.2 m drop test; and

b) lamps containing only gases of Division 2.2 provided they are packaged so that the projectile effects of any rupture of the bulb will be contained within the package.

Segment 1 Section3

(1)The following is a list of definitions of commonly used terms in these Technical Standards. Definitions of terms which have their usual dictionary meanings or are used in the common technical sense are not included. Definitions of additional terms used solely in conjunction with radioactive material are contained in . 0002-2001he technical standards

Aerosol or aerosol dispenser.

An article consisting of a non-refillable receptacle meeting the requirements of Segment 6; made of metal, glass or plastics and containing a gas, compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state or in a gaseous state.

Animal material.

Animal carcasses, animal body parts, foodstuffs or feedstuffs derived from animals.

For the transport of radioactive material:

Multilateral approval*.* The approval by the relevant competent authority of the country of origin of the design or shipment, as applicable, and also, where the consignment is to be transported through or into any other country, approval by the competent authority of that country.

Unilateral approval. The approval of a design which is required to be given by the competent authority of the country of origin of the design only.

ASTM.

The American Society for Testing and Materials (ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States).

Bag.

A flexible packaging made of paper, plastic film, textiles, woven material or other suitable materials

A packaging with complete rectangular or polygonal faces, made of metal, wood, plywood, reconstituted wood, fibreboard, plastic or other suitable material. Small holes for purposes such as ease of handling or opening, or to meet classification requirements, are permitted as long as they do not compromise the integrity of the packaging during transport.

Bundle of cylinders.

Not permitted for air transport. A pressure receptacle comprising an assembly of cylindersor cylinder shells that are fastened together and which are interconnected by a manifold and transported as a unit.

Cargo aircraft.

Any aircraft, other than a passenger aircraft, which is carrying goods or property.

Cargo Transport unit.

A multimodal freight container or portable tank

A cargo transport unit which totally encloses the contents by permanent structures with complete and rigid surfaces. Cargo transport units with fabric sides or tops are not considered closed cargo transport units.

Closed cryogenic receptacle.

A thermally insulated pressure receptacle for refrigerated liquefied gases of a water capacity of not more than 1 000 litres.

Closure.

A device which closes an opening in a receptacle.

Combination packaging.

A combination of packagings for transport purposes, consisting of one or more inner packagings secured in an outer packaging in accordance with the relevant provisions of Segment 4.

Competent authority.

Anybody or authority designated or otherwise recognized as such for any purpose in connection with these Technical Standards.

Compliance assurance.

A systematic programme of measures applied by an appropriate authority which is aimed at ensuring that the provisions of these Technical Standards are met in practice.

Composite packaging.

A packaging consisting of an outer packaging and an inner receptacle so constructed that the inner receptacle and the outer packaging form an integral packaging. Once assembled, it remains thereafter an integrated single unit; it is filled, stored, transported and emptied as such.

Confinement system.

For the transport of radioactive material, the assembly of fissile material and packaging components specified by the designer and agreed to by the competent authority as intended to preserve criticality safety.

Consignee.

Any person, organization or government which is entitled to take delivery of a consignment.

Consignment.

One or more packages of dangerous goods accepted by an operator from one shipper at one time and at one address, receipted for in one lot and moving to one consignee at one destination address.

Containment system.

For the transport of radioactive material, the assembly of components of the packaging specified by the designer as intended to retain the radioactive material during transport.

Control temperature.

The maximum temperature at which the substance can be safely transported. It is assumed that during transport the temperature of the immediate surroundings of the package does not exceed 55°C and attains this value for a relatively short time only during each period of 24 hours.

Crate.

An outer packaging with incomplete surfaces.

Critical temperature.

The temperature above which the substance cannot exist in the liquid

state.

Criticality safety index (CSI) assigned to a package, overpack or freight container containing fissile material.

For the transport of radioactive material, a number which is used to provide control over the accumulation of packages, overpacks or freight containers containing fissile material.

Cylinder.

A pressure receptacle of a water capacity not exceeding 150 litres.

Dangerous goods security

Measures or precautions to be taken by operators**,** shippers and others involved in the transport of dangerous goods aboard aircraft to minimize theft or misuse of dangerous goods that may endanger persons or property.

Degree of filling.

The ratio, expressed in percentage, of the volume of liquid or solid introduced at 15ºC into the means of containment and the volume of the means of containment ready for use.

Design.

For the transport of radioactive material, the description of fissile material excepted under Segment 2; special form radioactive material, low dispersible radioactive material, package or packaging which enables such items to be fully identified. The description may include specifications, engineering drawings, reports demonstrating compliance with regulatory requirements, and other relevant documentation.

Design life.

For composite cylinders and tubes, the maximum life (in number of years) to which the cylinder or tube is designed and approved in accordance with the applicable standard.

Dose rate.

The ambient dose equivalent or the directional dose equivalent, as appropriate, per unit time, measured at the point of interest.

Drum.

A flat-ended or convex-ended cylindrical packaging made of metal, fibreboard, plastic, plywood or other suitable materials. This definition also includes packagings of other shapes, such as round taper-necked packagings, or pail-shaped packagings. Jerricans are not covered by this definition.

Elevated temperature substance.

A substance which is transported or offered for transport:

in the liquid state at a temperature at or above 100°C;

- in the liquid state with a flashpoint above 60°C and which is intentionally heated to a temperature above its flashpoint; or
- in a solid state and at a temperature at or above 240°C.

EN

(standard). A European standard published by the European Committee for Standardization (CEN) (CEN – 36 rue de Stassart, B-1050 Brussels, Belgium).

Exclusive use.

For the transport of radioactive material, the sole use, by a single shipper, of an aircraft or of a large freight container, in respect of which all initial, intermediate and final loading and unloading and shipment are carried out in accordance with the directions of the shipper or consignee, where so required by these Technical Standards.

Explosive article.

An article containing one or more explosive substances.

Explosive substance.

A solid or liquid substance (or a mixture of substances) which is capable by chemical reaction of producing gas at such temperature and pressure and at such a speed as to cause damage to the surroundings. Included are pyrotechnic substances even when they do not evolve gases. A substance which is not itself an explosive, but which can form an explosive atmosphere of gas, vapour or dust is not included.

Filling ratio.

The ratio of the mass of gas to the mass of water at 15°C that would fill completely a pressure receptacle fitted ready for use.

Flash point.

The lowest temperature of a liquid at which flammable vapour is given off in a test vessel in sufficient concentration to be ignited in air when exposed momentarily to a source of ignition.

Freight container.

See unit load device.

Freight forwarder.

A person or organization who offers the service of arranging the transport of cargo by air.

Fuel cell.

An electrochemical device that converts the chemical energy of a fuel to electrical energy, heat and reaction products.

Fuel cell engine.

A device used to power equipment, and which consists of a fuel cell and its fuel supply, whether integrated with or separate from the fuel cell, and includes all appurtenances necessary to fulfil its function.

GHS.

The tenth revised edition of the *Globally Harmonized System of Classification and Labelling of Chemicals*, published by the United Nations as document ST/SG/AC.10/30/Rev.10.

Gross mass.

The total mass of the package.

IAEA.

The International Atomic Energy Agency (IAEA, P.O. Box 100 – A 1400 Vienna, Austria).

IAEA Regulations for the Safe Transport of Radioactive Material. One of the editions of those Regulations, as follows:

a) for the 1985, 1985 (as amended 1990) editions: IAEA Safety Series No. 6;
b) for the 1996 edition: IAEA Safety Series No. ST-1;

c) for the 1996 (revised) edition: IAEA Safety Series No. TS-R-1 (ST-1, Revised);
d) for the 1996 (as amended 2003), 2005, 2009 editions: IAEA Safety Standards Series No. TS-R-1;
e) for the 2012 edition: IAEA Safety Standards Series No. SSR-6; or
f) for the 2018 edition: IAEA Safety Standards Series No. SSR-6 (Rev.1).

ID number.
A temporary identification number for entries in Table 3-1 – Dangerous Goods List – which have not been assigned a UN number.

IEC.
The International Electrotechnical Commission (IEC, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland).

IMO.
The International Maritime Organization (IMO, 4 Albert Embankment, London SE1 7SR, United Kingdom).

Incompatible.
Describing dangerous goods which, if mixed, would be liable to cause a dangerous evolution of heat or gas or produce a corrosive substance.

Inner packaging.
A packaging for which an outer packaging is required for transport.

Inner receptacle.
A receptacle which requires an outer packaging in order to perform its containment function.

Inner vessel.
For a closed cryogenic receptacle, the pressure vessel intended to contain the refrigerated liquefied gas.

Inspection body.
An independent inspection and testing body approved by the appropriate national authority.

Intermediate bulk container (IBC).
Any rigid or flexible portable packaging, other than those specified in Segment 6;3 of these Technical Standards, as described in Section 6.5 of the UN Model Recommendations, that is designed for mechanical handling and is resistant to the stresses produced in handling and transport, as determined by tests.

Intermediate packaging.
A packaging placed between inner packaging's or articles and an outer packaging.

International System of Units (SI).
A rational and coherent system of units which provides the basis for the units of measurement used for air and ground operations as contained in Annex 5 to the Convention on International Civil Aviation.

ISO (standard).
An international standard published by the International Organization for Standardization (ISO – 1, ch. de la Voie-Creuse, CH-1211 Geneva 20, Switzerland).

Jerrican.
A metal or plastic packaging of rectangular or polygonal cross-section

Large packaging. A packaging consisting of an outer packaging which contains articles or inner packagings and which:

a) is designed for mechanical handling; and

b) exceeds 400 kg net mass or 450 litres capacity but has a volume of not more than 3 m^3;

Large salvage packaging. (Not permitted for air transport.) A special packaging which:

a) is designed for mechanical handling; and

b) exceeds 400 kg net mass or 450 litres capacity but has a volume of not more than 3 m^3;

into which damaged, defective, leaking or non-conforming dangerous goods packages, or dangerous goods that have spilled or leaked are placed for purposes of transport for recovery or disposal.

Liner.

A separate tube or bag inserted into a packaging but not forming an integral part of it, including the closures of its openings.

Liquid.

A substance classified as dangerous goods which at 50°C has a vapour pressure of not more than 300 kPa (3 bar), which is not completely gaseous at 20°C and at a pressure of 101.3 kPa, and which has a melting point or initial melting point of 20°C or less at a pressure of 101.3 kPa. A viscous substance for which a specific melting point cannot be determined must be subjected to the ASTM D 4359-90 test; or to the test for determining fluidity (penetrometer test) prescribed in section 2.3.4 of Annex A of the *Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)* (United Nations publication: ECE/TRANS/300 (Sales No. E.21.VIII.1).

Low dispersible radioactive material.

A solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Management system for the transport of radioactive material.

A set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner.

Manual of Tests and Criteria.

The eighth revised edition of the United Nations publication bearing this title (ST/SG/AC.10/11/Rev.8).

Maximum capacity.

The maximum inner volume of receptacles or packagings expressed in litres.

Maximum net mass.

The maximum net mass of contents in a single packaging or maximum combined mass of inner packagings and the contents thereof expressed in kilograms.

Maximum normal operating pressure.

For the transport of radioactive material, the maximum pressure above atmospheric pressure at mean sea level that would develop in the containment system in a period of one year under the conditions of temperature and solar radiation corresponding to environmental conditions in the absence of venting, external cooling by an ancillary system, or operational controls during transport.

Metal hydride storage system.

A single complete hydrogen storage system, including a pressure receptacle shell, metal hydride, pressure relief device, shut-off valve, service equipment and internal components used for the transport of hydrogen only.

Model Regulations.
The twenty-third revised edition of the United Nations publication entitled *Recommendations on the Transport of Dangerous Goods: Model Regulations* (ST/SG/AC.10/1/Rev.23).

Multiple-element gas container (MEGC).
(Not permitted for air transport.) A multimodal assembly of cylinders, tubes or bundles of cylinders which are interconnected by a manifold and which are assembled within a framework. The MEGC includes service equipment and structural equipment necessary for the transport of gases.

Net explosive mass (NEM).
The total mass of the explosive substances, without the packagings, casings, etc. (net explosive quantity (NEQ), net explosive contents (NEC), or net explosive weight (NEW) are often used to convey the same meaning).

Net quantity. Either:

a) the mass or volume of the dangerous goods contained in a package excluding the mass or volume of any packaging material; or
b) the mass of an unpackaged article of dangerous goods (such as UN 3166).

For the purposes of this definition, "dangerous goods" means the substance or article as described by the proper shipping name shown in Table 3-1, such as for "Fire extinguishers", the net quantity is the mass of the fire extinguisher. For articles packed with equipment or contained in equipment, the net quantity is the net mass of the article, such as for lithium ion batteries contained in equipment, the net quantity is the net mass of the lithium-ion batteries in the package.

Neutron radiation detector.
A device that detects neutron radiation. In such a device, a gas may be contained in a hermetically sealed electron tube transducer that converts neutron radiation into a measurable electric signal.

Open cryogenic receptacle.
A transportable thermally insulated receptacle for refrigerated liquefied gases maintained at atmospheric pressure by continuous venting of the refrigerated liquefied gas.

Outer packaging.
The outer protection of a composite or combination packaging together with any absorbent materials, cushioning and any other components necessary to contain and protect inner receptacles or inner packagings.

Overpack.
An enclosure used by a single shipper to contain one or more packages and to form one handling unit for convenience of handling and stowage.
Note. — A unit load device is not included in this definition.

Package.
The complete product of the packing operation, consisting of the packaging and its contents prepared for transport.

Packaging.
One or more receptacles and any other components or materials necessary for the receptacles to perform their containment and other safety functions.

Passenger aircraft.
An aircraft that carries any person other than a crew member, an operator's employee in an official capacity, an authorized representative of an appropriate national authority or a person accompanying a consignment or other cargo.

Portable tank.
For the definition of portable tanks.

Pressure drum.

*(*Not permitted for air transport.) A welded pressure receptacle of a water capacity exceeding 150 litres and of not more than 1 000 litres (such as cylindrical receptacles equipped with rolling hoops, spheres on skids).

Pressure receptacle.

A transportable receptacle intended for holding substances under pressure including its closure(s) and other service equipment and a collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles, metal hydride storage systems, bundles of cylinders and salvage pressure receptacles.

Pressure receptacle shell.

A cylinder, a tube, a pressure drum or a salvage pressure receptacle without its closures or other service equipment, but including any permanently attached device(s) such as a neck ring or a foot ring.

Pyrotechnic substance.

A mixture or compound designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic, chemical reactions.

Quality assurance.

A systematic programme of controls and inspections applied by any organization or body which is aimed at providing adequate confidence that the standard of safety prescribed by these Technical Standards is achieved in practice.

Radiation detection system.

An apparatus that contains radiation detectors as components.

Radioactive contents.

For the transport of radioactive material, the radioactive material together with any contaminated or activated solids, liquids, and gases within the packaging.

Receptacle.

A containment vessel for receiving and holding substances or articles, including any means of closing.

Reconditioned packagings include:

a) **metal drums that are:**
b) cleaned to original materials of construction, with all former contents, internal and external corrosion, and external coatings and labels removed;
c) restored to original shape and contour, with chimes (if any) straightened and sealed, and all non-integral gaskets replaced; and
d) inspected after cleaning but before painting, with rejection of packagings with visible pitting, significant reduction in material thickness, metal fatigue, damaged threads or closures, or other significant defects;
e) **plastic drums and jerricans that:**
f) are cleaned to original materials of construction, with all former contents, external coatings and labels removed;
g) have all non-integral gaskets replaced; and

Recycled plastics material.

Material recovered from used industrial packagings or from other plastics material that has been pre-sorted and prepared for processing into new packagings, including IBCs. The specific properties of the recycled material used for production of new packagings, including IBCs, must be assured and documented regularly as part of a quality assurance programme recognized by the appropriate national authority. The quality assurance programme must include a record of proper pre-sorting and verification that each batch of recycled plastics, which is of homogeneous composition, is consistent with the material specifications (melt flow rate, density and tensile properties) of the design type manufactured from such recycled material. This necessarily includes knowledge about the plastics material from which the recycled plastics have been derived, as well as awareness of the prior use, including prior contents, of the plastics material if that prior use might reduce the capability of new packagings, including IBCs, produced using that material. In addition, the manufacturer's quality assurance programme for packagings under 6;1.1.3 of these Technical Standards or IBCs under 6.5.4.1 of the UN Model Regulations must include performance of the mechanical design type test on packagings in Segment 6, Section 4 of these Technical Standards or IBCs in 6.5.6 of the UN Model Regulations, manufactured from each batch of recycled plastics material. In this testing, stacking performance may be verified by appropriate dynamic compression testing rather than static load testing.

Remanufactured large packaging.

(Not permitted for air transport.) A metal or rigid plastics large packaging that:

a) is produced as a UN type from a non-UN type; or
b) is converted from one UN design type to another UN design type.

Remanufactured large packagings are subject to the same requirements of the UN Model Regulations that apply to new large packagings of the same type (see also design type definition in 6.6.5.1.2 of the UN Model Regulations).

Remanufactured packagings include:

a) metal drums that:
   i) are produced as a UN type from a non-UN type;
   ii) are converted from one UN type to another UN type; or
   iii) undergo the replacement of integral structural components (such as non-removable heads);
b) plastic drums that:
   i) are converted from one UN type to another UN type (such as 1H1 to 1H2); or
   ii) undergo the replacement of integral structural components.

Remanufactured drums are subject to the same requirements of these Technical Standards as apply to a new drum of the same type.

Reused large packaging.

(Not permitted for air transport.) A large packaging to be refilled which has been examined and found free of defects affecting the ability to withstand the performance tests: the term includes those which are refilled with the same or similar compatible contents and are transported within distribution chains controlled by the consignor of the product.

Reused packaging.

A packaging to be refilled which has been examined and found free of defects affecting the ability to withstand the performance tests; the term includes those which are refilled with the same or similar compatible contents and are transported within distribution chains controlled by the shipper of the product.

Salvage packaging.
A special packaging into which damaged, defective, leaking or nonconforming dangerous goods packages, or dangerous goods that have spilled or leaked, are placed for purposes of transport for recovery or disposal.

Salvage pressure receptacle.
(Not permitted for air transport.) A pressure receptacle with a water capacity not exceeding 3 000 litres into which are placed damaged, defective, leaking or non-conforming pressure receptacle(s) for the purpose of transport, such as for recovery or disposal.

Self-accelerating decomposition temperature (SADT).
The lowest temperature at which self-accelerating decomposition may occur in a substance in the packaging, IBC or portable tank as offered for transport. The SADT must be determined in accordance with the test procedures given in Part II, Section 28 of the UN *Manual of Tests and Criteria*.
Note. — IBC and portable tanks are not permitted for transport by air unless otherwise provided for in these Technical Standards.

Self-accelerating polymerization temperature (SAPT).
The lowest temperature at which self-accelerating polymerization may occur with a substance in the packaging, IBC or portable tank as offered for transport. The SAPT must be determined in accordance with the test procedures established for the self-accelerating decomposition temperature for self-reactive substances in accordance with Part II, Section 28 of the UN *Manual of Tests and Criteria.*

Serious injury. An injury which is sustained by a person in an accident and which:

a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or
b) results in a fracture of any bone (except simple fractures of fingers, toes or nose); or
c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or
d) involves injury to any internal organ; or
e) involves second- or third-degree burns, or any burns affecting more than 5 per cent of the body surface; or
f) involves verified exposure to infectious substances or injurious radiation.

Service equipment. For pressure receptacles, include:

a) closure(s);
b) manifold(s);
c) piping;
d) porous, absorbent or adsorbent material; and
e) any structural devices such as those used for handling.

Service life.
For composite cylinders and tubes, the number of years the cylinder or tube is permitted to be in service.

Settled pressure.
The pressure of the contents of a pressure receptacle in thermal and diffusive equilibrium.

Shipment.
The specific movement of a consignment from origin to destination

Sift proof packaging.
A packaging impermeable to dry contents including fine solid material produced during transport.

Single packaging.

A packaging which does not require any inner packaging to perform its containment function during transport.

Solid dangerous goods.

Dangerous goods, other than gases, do not meet the definition of Liquid dangerous goods.

State of Destination.

The State in the territory of which the consignment is finally to be unloaded from an aircraft.

State of Origin.

The State in the territory of which the consignment is first to be loaded on an aircraft.

State of Registry.

The State on whose register the aircraft is entered.

State of the Operator.

The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

Stores (supplies).

Stores (supplies) for consumption; and b) Stores (supplies) to be taken away.

Stores (supplies) for consumption. Goods, whether or not sold, intended for consumption by the passengers and the crew on board aircraft, and goods necessary for the operation and maintenance of aircraft, including fuel and lubricants.

Stores (supplies) to be taken away. Goods for sale to the passengers and the crew of aircraft with a view to landing.

Items that meet the classification as dangerous goods and which are transported in accordance with Segment 1; are considered as "cargo".

Tank.

A tank container, portable tank, a road tank-vehicle, a rail tank-wagon or a receptacle intended to contain solids, liquids, or gases and has a capacity of not less than 450 litres when used for the transport of gases as defined in Segment 2.

Note. — These TECHNICAL STANDARDS *do not permit the use of a tank for the transport of radioactive material by air.*

Test pressure.

The required pressure applied during a pressure test for qualification or re-qualification.

Transport index (TI) assigned to a package, overpack or freight container, or to unpackaged LSA-I, SCO-I or SCO-III.

For the transport of radioactive material, a number which is used to provide control over radiation exposure.

Through or into.

For the transport of radioactive material, through or into the countries in which a consignment is transported but specifically excluding countries "over" which a consignment is carried by air, provided that there are no scheduled stops in those countries.

Tube.

(Not permitted for air transport.) A pressure receptacle of seamless or composite construction which has a water capacity exceeding 150 litres but not more than 3 000 litres.

UNECE.

The United Nations Economic Commission for Europe (UNECE, Palais des Nations, 8-14 avenue de la Paix, CH-1211 Geneva 10, Switzerland).

Unit load device.

Any type of freight container, aircraft container, aircraft pallet with a net or aircraft pallet with a net over an igloo.

Note 1. — An overpack is not included in this definition.

Note 2. A freight container for radioactive material is not included in this definition (see 2;7.1.3).

UN number.

The four-digit number assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals to identify an article or substance or a particular group of articles or substances.

Working pressure. Either:

a) for a compressed gas, the settled pressure at a reference temperature of 15°C in a full pressure receptacle;

b) for UN 1001 acetylene, dissolved, the calculated settled pressure at a uniform reference temperature of 15°C in an acetylene cylinder containing the specified solvent content and the maximum acetylene content; or

c) for UN 3374 acetylene, solvent free, the working pressure which was calculated for the equivalent cylinder for UN 1001 acetylene, dissolve

(2)The following explanations and examples are meant to assist in clarifying the use of some of the packaging terms defined in this section.

The definitions in this section are consistent with the use of defined terms throughout the Technical Standards. However, some of the defined terms are commonly used in other ways. This is particularly evident in respect of the term “inner receptacle” which has often been used to describe the “inners” of a combination packaging.

The “inners” of “combination packagings” are always termed “inner packagings” not “inner receptacles”. A glass bottle is an example of such an “inner packaging”.

The “inners” of “composite packagings” are normally termed “inner receptacles”. For example, the “inner” of a 6HA1 composite packaging (plastic material) is such an “inner receptacle” since it is normally not designed to perform a containment function without its “outer packaging” and is therefore not an “inner packaging”.

(3)The units of measurement to be used in the transport of dangerous goods by air are those specified by the International System (SI) as modified for international civil aviation by Annex 5 to the Chicago Convention. The primary units of mass and volume will be:

- Kilogram (kg)
- Litre (L)
- Unit of pressure will be the kilopascal (kPa).
- Except as specifically provided for in these Technical Standards, only those abbreviations for units of measurement that are indicated in this paragraph, or in Annex 5 to the Chicago Convention, may be used in the transport of dangerous goods by air.

(4)It is recognized that there are in existence many packagings which were designed and constructed for use with non-SI quantity limitations and that such packagings will continue to be used for some time to come. Table 1-1 therefore contains a list of authorized non-SI equivalents for quantity limitations expressed in SI units. It is stressed that these are not precise equivalents but are nevertheless acceptable based upon the likely availability of

packaging.

(5)Precise conversion factors for commonly used SI units are given in Annex 5 to the Chicago Convention. Tables 1-2 and 1-3 show conversion factors, to four significant figures, for some units widely used in dangerous goods transport.

6) The units of measurement to be used in the transport of dangerous goods by air are those specified by the International System (SI) as modified for international civil aviation by Annex 5 to the Chicago Convention. The primary units of mass and volume will be:

i)Kilogram (kg)
ii)Litre (L)
iii)Unit of pressure will be the kilopascal (kPa).
iv)Except as specifically provided for in these Technical Standards, only those abbreviations for units of measurement that are indicated in this paragraph, or in Annex 5 to the Chicago Convention, may be used in the transport of dangerous goods by air

7)It is recognized that there are in existence many packagings which were designed and constructed for use with non-SI quantity limitations and that such packagings will continue to be used for some time to come. Table 1-1 therefore contains a list of authorized non-SI equivalents for quantity limitations expressed in SI units. It is stressed that these are not precise equivalents but are nevertheless acceptable based upon the likely availability of packaging.

8)Precise conversion factors for commonly used SI units are given in Annex 5 to the Chicago Convention. Tables 1-2 and 1-3 show conversion factors, to four significant figures, for some units widely used in dangerous goods transport.

Table 1-1. Authorized equivalents

Volume	*Volume*	*Volume*
Litres	*Imperial*	*U.S*
0.5	1 pt	1 pt
1	1 qt	1 Qt
2	2 qt	2 Qt
2.5	5 pt	5 Pt
5	1 gal	1.25 Gal
10	2 gal	2.5 Gal
15	3 gal	3.75 Gal
20	4.25 gal	5 Gal
25	5.5 gal	6.25 Gal
30	6.5 gal	7.5 Gal
42	9 gal	11 Gal
50	11 gal	13 Gal
60	13 gal	15 Gal
100	22 gal	25 Gal
120	26 gal	30 Gal
220	48 gal	55 Gal
250	55 gal	62.5 Gal

Table 1-2. Conversion to SI units*

To convert	*to*	*Multiply by*
Bar	kilopascals (kPa)	100.0
curie (Ci)	gigabecquerel (GBq)	37.00
Feet	metres (m)	0.304 8
Rem	sievert (Sv)	0.010 00
gallons (Imperial)	litres (L)	4.546
gallons (U.S. liquid)	litres (L)	3.785
Inches	millimetres (mm)	25.40
kilogram-force (kgf)	newton (N)	9.807
kilograms per square centimetre	kilopascals (kPa)	98.07
Oersted	amperes per metre (A/m)	79.58
ounces, fluid (Imperial)	millilitres (mL)	28.41
ounces, fluid (U.S.)	millilitres (mL)	29.57
pints (Imperial)	litres (L)	0.568 3
pints (U.S.)	litres (L)	0.473 2
pounds (avoirdupois)	kilograms (kg)	0.453 6
pounds per square inch	kilopascals (kPa)	6.895
quarts (Imperial)	litres (L)	1.137
quarts (U.S.)	litres (L)	0.946 4

Table 1-3. Conversion from SI units*

To convert	*to*	*Multiply by*
amperes per metre (A/m)	oersted	0.012 57
degrees Celsius (°C)	degrees Fahrenheit (°F)	multiply by 9/5 and add 32°F
gray (Gy)	rad	100.0
kilograms (kg)	pounds	2.205
kilopascals (kPa)	bar	0.010 00
kilopascals (kPa)	kilograms per square centimetre	0.010 20
kilopascals (kPa)	pounds per square inch	0.145 0
metres (m)	feet	3.281
millilitres (mL)	ounces, fluid (Imperial)	0.035 20
millilitres (mL)	ounces, fluid (U.S.)	0.033 81
millimetres (mm)	inches	0.039 37
newton (N)	kilogram-force (kgf)	0.1020
terabecquerel (TBq)	curie (Ci)	27.03
litres (L)	gallons (Imperial)	0.220 0
litres (L)	gallons (U.S. liquid)	0.264 2
litres (L)	pints (Imperial)	1.760
litres (L)	pints (U.S.)	2.113
litres (L)	quarts (Imperial)	0.879 9
litres (L)	quarts (U.S.)	1.057

*Where a prefix is used, it indicates a multiplying factor as follows:
tera (T) $\times 10^{12}$
giga (G) $\times 10^{9}$
mega (M) $\times 10^{6}$
kilo (k) $\times 10^{3}$
milli (m) $\times 10^{-3}$
micro (μ) $\times 10^{-6}$
nano (n) $\times 10^{-9}$

Segment 1 Section 5

3)The requirements in this Section are intended to supplement the requirements of Annex 17 and to implement measures to be taken to minimize theft or misuse of dangerous goods that may endanger people or property.

4)The provisions of this Section do not supersede requirements of Annex 17 or the Aviation Security Manual.

5)All persons engaged in the transport of dangerous goods should consider security requirements for the dangerous goods commensurate with their responsibilities.

1)Dangerous goods should only be offered to operators that have been appropriately identified.

2)The provisions of this Section do not apply to:

a) **UN 2908** (Radioactive material, excepted package-empty packaging) and **UN 2909** (Radioactive material, excepted package-articles manufactured from natural thorium or uranium) excepted packages;

b) **UN 2910** (Radioactive material, excepted package-limited quantity of material) and UN 2911(Radioactive material, excepted package-articles and instruments) excepted packages with an activity level not exceeding the A_2 value; and

c) **UN 2912** (Radioactive material, low specific activity-LSA-I, non-fissile or fissile excepted) and UN 2913 SCO-I. (Radioactive material, surface contaminated objects, non-fissile or fissile excepted)

6)The training specified in Technical Instructions (objective of training) should include elements of security awareness.

7)Security awareness training should address the following:

i)nature of security risks

ii)recognizing security risks methods to address and reduce such risks,

iii)actions to be taken in the event of a security breach. It should include awareness of security plans (if appropriate) commensurate with the responsibilities of individuals and their part in implementing security plans.

8)Such training should be provided or verified upon employment in a position involving dangerous goods transport. Recurrent training should take place within 24 months of previous training to ensure knowledge is current.

9) Records of all dangerous goods security training undertaken should be kept by the employer and made available to the employee or appropriate national authority upon request. Records should be kept by the employer for a period of time established by the appropriate national authority.

8)High consequence dangerous goods are those which have the potential for misuse in a terrorist event, and which may, as a result, produce serious consequences such

as:

i)mass casualties,
ii)mass destruction or,
iii)particularly for Class 7, mass socio-economic disruption.

9)An indicative list of high consequence dangerous goods in classes and divisions other than Class 7 is given in Table

Table 1-5. Indicative list of high consequence dangerous goods

Class 1 Division 1.1 explosives
Class 1 Division 1.2 explosives
Class 1 Division 1.3 compatibility group C explosives
Class 1 Division **1.4 UN Nos. 0104, 0237, 0255, 0267, 0289, 0361, 0365, 0366, 0440, 0441, 0455, 0456, 0500, 0512 and 0513**
Class 1 Division 1.5 explosives
Class 1 Division 1.6 explosives
Division 2.3 toxic gases (excluding aerosols)
Class 3 desensitized explosives
Division 4.1 desensitized explosives
Division 6.1 substances of Packing Group I; except when transported under the excepted quantity provisions in 3;5
Division 6.2 infectious substances of Category A (UN Nos. 2814 (Infectious substance, affecting humans* solid) and 2900 (Infectious substance affecting animals*) and medical waste of Category A (UN 3549 Medical waste, Category A, affecting animals and humans-solid)

10)For dangerous goods of Class 7, high consequence radioactive material is that with an activity equal to or greater than a transport security threshold of 3 000 A_2 per single package (the following basic values for individual radionuclides are given in table 2-12- a) A1 and A2 in TBq b) activity concentration limits for exempt material in Bq/g, and c) activity limits for exempt consignments in Bq except for the following radionuclides where the transport security threshold is given in Table 1-6 below.

Transport security thresholds for specific radionuclides

Element	***Transport security threshold (TBq)***	***Radionuclide***
Americium	0.6	Am-241
Gold	2	Au-198
Cadmium	200	Cd-109
Californium	0.2	Cf-252
Curium	0.5	Cm-244
Cobalt	7	Co-57
Cobalt	0.3	Co-60
Caesium	1	Cs-137
Iron	8000	Fe-55
Gadolinium	10	Gd-153
Germanium	7	Ge-68

Iridium	0.8	Ir-192
Nickel	600	Ni-63
Palladium	900	Pd-103
Promethium	400	Pm-147
Polonium	0.6	Po-210
Plutonium	0.6	Pu-238
Plutonium	0.6	Pu-239

Element	*Transport security threshold (TBq)*	*Radionuclide*
Radium	0.4	Ra-226
Ruthenium	3	Ru-106
Selenium	2	Se-75
Strontium	10	Sr-90
Thallium	200	Tl-204
Thulium	200	Tm-170
Ytterbium	3	Yb-169

11)For mixtures of radionuclides, determination of whether or not the transport security threshold has been met or exceeded can be calculated by summing the ratios of activity present for each radionuclide divided by the transport security threshold for that radionuclide. If the sum of the fractions is less than 1, then the radioactivity threshold for the mixture has not been met nor exceeded.

This calculation can be made with the formula:

$$\sum_{i} \frac{A_i}{T_i} < 1$$

Where:
A_i = activity of radionuclide *i* that is present in

a package (TBq) T_i = transport security

threshold for radionuclide *i* (TBq).

12)When radioactive material possesses subsidiary hazards of other classes or divisions, the criteria of Table 1-5 should also be taken into account: In addition to the radioactive and fissile properties, any subsidiary hazard of the contents of a package, such as:

a)Explosiveness
b)Flammability
c)Pyrophoricity
d)Chemical toxicity
e)Corrosiveness

11)Must consider the following in order to be in compliance with all relevant provisions for dangerous goods of these Technical Standards

a)Documentation
b)Packing
c)Labelling
d)Marking
e)Placarding
f)Stowage
g)Segregation
f)transport

12)Operators, shippers and others (including infrastructure managers) engaged in the transport of high consequence dangerous goods should adopt, implement and comply with a security plan that addresses at least the elements specified in Segment 5.4. in the Technical Standards.

13)The security plan should comprise at least the following elements:

a)specific allocation of responsibilities for security to competent and qualified people with appropriate authority to carry out their responsibilities;

b)records of dangerous goods or types of dangerous goods transported;

c)review of current operations and assessment of vulnerabilities, including inter-modal transfer, temporary transit storage, handling, and distribution, as appropriate;

d)clear statement of measures including training policies (including response to higher threat conditions, new employee/ employment verifications, etc.), operating practices (such as access to dangerous goods in temporary storage, proximity to vulnerable infrastructure, etc.), equipment and resources that are to be used to reduce security risks;

e)effective and up-to-date procedures for reporting and dealing with security threats, breaches of security or security incidents;

f)procedures for the evaluation and testing of security plans and procedures for periodic review and update of the plans;

g)measures to ensure the security of transport information contained in the plan; and

h)measures to ensure that the distribution of the transport information is limited as far as possible. (Such measures must not preclude provision of the transport documentation required by Segment 5, Section 4 of these Technical Standards.

14)For radioactive material, the provisions of this Section are deemed to be complied with when the provisions of:

a)the Convention on Physical Protection of Nuclear Material **(INFCIRC/274/Rev.1, IAEA, Vienna** (1980)) and

b)he IAEA circular on “Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities” **INFCIRC/225/Rev.5, IAEA, Vienna** (2011) are applied.

Segment 1 Section 6

2)The objective of these Technical Standards is to establish requirements that must be satisfied to ensure safety and to protect people, property and the environment from harmful effects of ionizing radiation during the transport of radioactive material. This protection is achieved by requiring:

1)prevention of criticality;
2)control of external dose rate
3)prevention of damage caused by heat.
4)containment of the radioactive contents;

3.These requirements are satisfied firstly by applying a graded approach to the limits of the contents for packages and aircraft and to the performance standards, which are applied to package designs depending upon the hazard of the radioactive contents. Secondly, they are satisfied by imposing conditions on the design and operation of packages and on the maintenance of the packagings, including consideration of the nature of the radioactive contents. Thirdly, they are satisfied by requiring administrative controls including, where appropriate, approval by competent authorities. Finally, further protection is provided by making arrangements for planning and preparing emergency response to protect people, property and the environment.

4)These Technical Standards apply to the transport of radioactive material by air, including transport that is incidental to the use of the radioactive material. Transport comprises all operations and conditions associated with and involved in the movement of radioactive material; these include the design, manufacture, maintenance and repair of packaging, and the preparation, consigning, loading, carriage including in-transit storage, unloading and receipt at the final destination of the radioactive material and packages. A graded approach is applied to the performance standards in these Technical Standards that are characterized by three general severity levels:

Severity Level 1: Routine conditions of transport (incident free);
Severity Level 2: Normal conditions of transport (minor mishaps); and
Severity Level 3: Accident conditions of transport.

5)These Technical Standards do not apply to any of the following:

a) radioactive material implanted or incorporated into a person or live animal for diagnosis or treatment;

b) radioactive material in or on a person who is to be transported for medical treatment because the person has been subject to accidental or deliberate intake of or contamination from radioactive material, taking into account the necessary radiological protection measures with respect to other passengers and crew, subject to approval by the operator;

c) radioactive material in consumer products which have received regulatory approval, following their sale to the end user;

3)natural material and ores containing naturally occurring radionuclides (which may have been processed), provided the activity concentration of the material does not exceed 10 times the values specified in Table 2-12 or calculated in accordance with Segment 2. For natural materials and ores containing naturally occurring radionuclides that are not in secular equilibrium, the calculation of the activity concentration must be performed in accordance with Segment 2;

4)non-radioactive solid objects with radioactive substances present on any surfaces in quantities not more than the limit specified in the definition of contamination in Segment 2;7.

5)Excepted packages which may contain radioactive material as specified in Segment 2;7 are subject only to the following provisions of Segments 5 to 7.

a) the applicable provisions specified in Segment 5;
; and

b) the requirements for excepted packages specified in Segment 6;7; An excepted package must be designed to meet the requirements specified in 92.01.29-41

except when the radioactive material possesses other hazardous properties and has to be classified in a class other than Class 7 in accordance with Special Provision A130 or A194, where the provisions listed in a) and b) above apply only as relevant and in addition to those relating to the main class or division.

6)Excepted packages are subject to the relevant provisions of all other parts of these Technical Standards.

7)The transport of radioactive material must be subject to a radiation protection programme, which must consist of systematic arrangements aimed at providing adequate consideration of radiation protection measures.

8)Doses to persons must be below the relevant dose limits. Protection and safety must be optimized in order that the magnitude of individual doses, the number of persons exposed and the likelihood of incurring exposure must be kept as low as reasonably achievable, economic and social factors being taken into account, within the restriction that the doses to individuals are subject to dose constraints. A structured and systematic approach must be adopted and must include consideration of the interfaces between transport and other activities.

9)The nature and extent of the measures to be employed in the programme must be related to the magnitude and likelihood of radiation exposure. The programme must incorporate the requirements in Segment 6.2. and 92.01.29 to 41. Programme documents must be available, on request, for inspection by the relevant competent authority.

10)For occupational exposure arising from transport activities, where it is assessed that the effective dose either:

a) is likely to be between 1 and 6 mSv in a year, a dose assessment programme via must be conducted; or

b) is likely to exceed 6 mSv in a year, individual monitoring must be conducted.

10)When workplace monitoring or individual monitoring is conducted, appropriate records must be kept.

11)In the event of a nuclear or radiological emergency during the transport of radioactive material, provisions, as established by relevant national and/or international organizations, must be observed to protect people, property and the environment. This includes arrangements for preparedness and response established in accordance with

the national and/or international requirements and in a consistent and coordinated manner with the national and/or international emergency arrangements.

12)The arrangements for preparedness and response must be based on the graded approach and take into consideration the identified hazards and their potential consequences, including the formation of other dangerous substances that may result from the reaction between the contents of a consignment and the environment in the event of a nuclear or radiological emergency. Guidance for the establishment of such arrangements is contained in *Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series No. GSR Part 7, IAEA, Vienna (2015); *Criteria for Use in Preparedness and Response for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series No. GSG-2, IAEA, Vienna (2011); *Arrangements for Preparedness for a Nuclear or Radiological Emergency*, IAEA Safety Standards Series No. GS-G-2.1, IAEA, Vienna (2007), and *Arrangements for the Termination of a Nuclear or Radiological Emergency*, IAEA Safety Standards Series No. GSG-11, IAEA, Vienna (2018).

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13)Personnel must be appropriately trained in the radiation hazards involved and the precautions to be observed in order to ensure restriction of their exposure and that of other persons who might be affected by their actions.

14)A management system based on international, national or other standards acceptable to the competent authority must be established and implemented for all activities within the scope of the Technical Standards, as identified in Segment 1;6 to ensure compliance with the relevant provisions of these Technical Standards. Certification that the design specification has been fully implemented must be available to the competent authority. The manufacturer, shipper or user must be prepared to:

a)demonstrate compliance with these Technical Standards to the competent authority.

b)provide facilities for inspection during manufacture and use; and

15)Where competent authority approval is required, such approval must take into account and be contingent upon the adequacy of the management system.

16)Special arrangement means those provisions, approved by the competent authority, under which consignments which do not satisfy all the requirements of these Technical Standards applicable to radioactive material may be transported.

17)Consignments for which conformity with any provision applicable to radioactive material is impracticable must not be transported except under special arrangement. Provided the competent authority is satisfied that conformity with the radioactive material provisions of these Technical Standards is impracticable and that the requisite standards of safety established by these Technical Standards have been demonstrated through means alternative to the other provisions of these Technical Standards, the competent authority may approve special arrangement transport operations for a single consignment or a planned series of multiple consignments. The overall level of safety in transport must be at least equivalent to that which would be provided if all the applicable requirements in these Technical Standards had been met. For international consignments of this type, multilateral approval must be required.

18)In addition to the radioactive and fissile properties, any subsidiary hazard of the contents of a package, such as:

1)Explosiveness

2)Flammability

3)Pyrophoricity
4)Chemical toxicity
5)Corrosiveness

must also be taken into account in the documentation, packing, labelling, marking, placarding, stowage, segregation and transport, in order to be in compliance with all relevant provisions for dangerous goods of these Technical Standards.

19)In the event of non-compliance with any limit in these Technical Standards applicable to dose rate or contamination:

a) the shipper, consignee, operator and any organization involved during transport, who may be affected, as appropriate, must be informed of the non-compliance:
   i) by the operator if the non-compliance is identified during transport; or
   ii) by the consignee if the non-compliance is identified at receipt;
b) the shipper, operator or consignee, as appropriate, must:
   i) take immediate steps to mitigate the consequences of the non-compliance;
   ii) investigate the non-compliance and its causes, circumstances and consequences;
   iii) take appropriate action to remedy the causes and circumstances that led to the non-compliance and to prevent a recurrence of causes and circumstances similar to those that led to the non-compliance; and
   iv) communicate to the relevant competent authority(ies) the causes of the non-compliance and the corrective or

   v) preventative actions taken or to be taken;
c) the communication of the non-compliance to the shipper and relevant competent authority(ies), respectively, must be made as soon as practicable and it must be immediate whenever an emergency exposure situation has developed or is developing.

Section 7

1)Entities other than operators who are in possession of dangerous goods at the time a dangerous goods accident or incident occurs or at the time a dangerous goods incident is discovered to have occurred should follow the reporting requirements listed below:

2)An operator must report dangerous goods accidents and incidents to:

i)the appropriate authorities of the State of the Operator and
ii)the State in which the incident or accident occurred in accordance with the reporting requirements of those appropriate authorities.

3)Entities, other than operators, who discover undeclared or mis declared dangerous goods should follow the reporting requirements of as required in the Technical Standards. These entities may include, but are not limited to,

i)freight forwarders,
ii)customs authorities and
iii)security screening provide

Segment 2

Classification of Dangerous Goods

1. RESPONSIBILITIES

1.1 Classification must be made by the appropriate national authority when so required or may otherwise be made by the shipper.

1.2 Where classification of the dangerous goods is made by the shipper, information used by the shipper to assign a classification must be made available to the appropriate national authority upon request, if requested within three months of the date on which the dangerous goods were transported.

Note.— Examples of such information include:

- *the known composition of a substance;*
- *the known physical characteristics of articles such as vehicles;*
- *the results of classification testing and other applicable requirements as identified in SEGMENT 2 of these Instructions; or*
- *a safety data sheet issued in accordance with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).*

1.3 A shipper who has identified, on the basis of test data, that a substance listed by name in column 1 of the Dangerous Goods List in SEGMENT 3, Section 2, Table 3-1 meets classification criteria for a hazard class or division that is not identified in the list, may, with the approval of the appropriate national authority, consign the substance:

a) under the most appropriate generic or not otherwise specified (n.o.s.) entry reflecting all hazards; or

b) under the same UN number and name but with additional hazard communication information as appropriate to reflect the additional subsidiary hazard(s) (documentation, label) provided that the primary hazard class remains unchanged and that any other transport conditions (such as limited quantity, packaging provisions) that would normally apply to substances possessing such a combination of hazards are the same as those applicable to the substance listed.

1.3.1 A copy of the document of approval must accompany the consignment.

Note. — When an appropriate national authority grants such approvals, it should inform the United Nations Sub-Committee of Experts on the Transport of Dangerous Goods accordingly and submit a relevant proposal of amendment to the Dangerous Goods List. Should the proposed amendment be rejected, the appropriate national authority should withdraw its approval.

2. CLASSES, DIVISIONS, PACKING GROUPS – DEFINITIONS

2.1 Substances (including mixtures and solutions) and articles subject to these Technical Standardsare assigned to one of nine classes according to the hazard or the most predominant of the hazards they present. Some of these classes are subdivided into divisions. These classes and divisions are:

Class 1: Explosives

Division 1.1:	Substances and articles which have a mass explosion hazard
Division 1.2;	Substances and articles which have a projection hazard but not a mass explosion hazard
Division 1.3;	Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard
Division 1.4;	Substances and articles which present no significant hazard
Division 1.5;	Very insensitive substances which have a mass explosion hazard
Division 1.6;	Extremely insensitive articles which do not have a mass explosion hazard

Class 2: Gases

Division 2.1:	Flammable gases
Division 2.2;	Non-flammable gases, non-toxic gases
Division 2.3;	Toxic gases

Class 3: Flammable liquids

Class 4: Flammable solids; substances liable to spontaneous combustion; substances which, on contact with water, emit flammable gases

Division 4.1;	Flammable solids, self-reactive and related substances and solid desensitized explosives and polymerizing substances
Division 4.2;	Substances liable to spontaneous combustion
Division 4.3	Substances which, in contact with water, emit flammable gases

Class 5: Oxidizing substances and organic peroxides

Division 5.1;	Oxidizing substances
Division 5.2;	Organic Peroxides

Class 6: Toxic and infectious substances

Division 6.1;	Toxic substances
Division 6.2;	Infectious substances

Class 7

Radioactive material

Class 8:

Corrosive substances

Class 9:

Miscellaneous dangerous substances and articles, including environmentally hazardous substances

The numerical order of the classes and divisions is not that of the degree of danger.

2.2 Many of the substances assigned to Classes 1 to 9 are deemed, without additional labelling, as being environmentally hazardous.

2.3 Wastes must be transported under the requirements of the appropriate class considering their hazards and the criteria in these Instructions. Wastes not otherwise subject to these Instructions, but covered under the Basel Convention, may be transported under Class 9.

2.4 For packing purposes, dangerous goods other than those of Classes 1, 2 and 7, Divisions 5.2 and 6.2 and self-reactive substances of Division 4.1 are assigned to three packing groups in accordance with the degree of danger they present:

Packing Group I	Substances presenting a high danger
Packing Group II	Substances presenting a medium danger
Packing Group III	Substances presenting a low danger

The packing group to which a substance is assigned is indicated in the Dangerous Goods List in Segment 3, Section 2, Table 3-1.

Articles are not assigned to packing groups. For packing purposes, any requirement for a specific packaging performance level is set out in the applicable packing instruction.

2.5 Dangerous goods are determined to present one or more of the dangers represented by Classes 1 to 9 and divisions and, if applicable, the degree of danger on the basis of the requirements in SEGMENT 2, Sections 1 to 9.

2.6 Dangerous goods presenting a danger of a single class and division are assigned to that class and division and the degree of danger (packing group), if applicable, determined. When an article or substance is specifically listed by name in the Dangerous Goods List (Table 3-1), its class or division, its subsidiary hazard(s) and, when applicable, its packing group are taken from this list.

2.7 Dangerous goods meeting the defining criteria of more than one hazard class or division and which are not listed by name in Table 3-1 are assigned to a class and division and subsidiary hazard(s) on the basis of the precedence of hazards in 4.

3. UN NUMBERS AND PROPER SHIPPING NAMES

3.1 Dangerous goods are assigned to UN numbers and proper shipping names according to their hazard classification and their composition.

3.2 Dangerous goods commonly carried are listed in Table 3-1. Where an article or substance is specifically listed by name, it must be identified in transport by the proper shipping name in Table 3-1. Such substances may contain technical impurities (for example, those deriving from the production process) or additives for stability or other purposes that do not affect its classification. However, a substance listed by name containing technical impurities or additives for stability or other purposes affecting its classification must be considered a mixture or solution (see 3.5). For dangerous goods not specifically listed by name, "generic" or "not otherwise specified (n.o.s.)" entries are provided (see 3.8) to identify the article or substance in transport. The substances listed by name in column 1 of Table 3-1 must be transported according to their classification in the list or under the conditions specified in the Technical Instructions. Each entry in Table 3-1 is characterized by a UN number. Table 3-1 also contains relevant information for each entry, such as hazard class, subsidiary hazard(s) (if any), packing group (where assigned), packing requirements, passenger and cargo aircraft requirements, etc. Entries in Table 3-1 are of the following four types:

(a) **Single entries for well-defined substances or articles**

e.g.

Ethyl nitrite solution	UN 1194
Acetone	UN 1090

(b) **Generic entries for a well-defined group of substances or articles**

e.g.

Adhesives	UN 1133
Carbamate pesticide, solid, toxic	UN 2757
Perfumery products	UN 1266

(c) **Specific n.o.s. entries covering a group of substances or articles of a particular chemical or technical nature**

e.g.

Alcohols, n.o.s.	UN 1987
Nitrates, inorganic, n.o.s.	UN 1477

(d) **General n.o.s. entries covering a group of substances or articles meeting the criteria of one or more classes or divisions**

e.g.

Flammable liquid, n.o.s.	UN 1993
Flammable solid, organic, n.o.s.	UN 1325

3.3 All self-reactive substances of Division 4.1 are assigned to one of twenty generic entries in accordance with the classification principles and flow chart described in the UN Recommendations.

3.4 All organic peroxides of Division 5.2 are assigned to one of twenty generic entries in accordance with the classification principles and flow chart described in the UN Recommendations.

3.5 A mixture or solution meeting the classification criteria of these Technical Standardsand composed of a single predominant substance identified by name in Table 3-1 and one or more substances not subject to these Technical Standardsand/or traces of one or more substances identified by name in Table 3-1 must be assigned the UN number and proper shipping name of the predominant substance named in Table 3-1, unless:

a) the mixture or solution is identified by name in Table 3-1 in which case this name must be applied; or

b) the name and description of the substance named in Table 3-1 specifically indicates that it applies only to the pure substance; or

c) the hazard class or division, subsidiary hazard(s), physical state or packing group of the solution or mixture is different from that of the substance named in Table 3-1; or

d) the hazard characteristics and properties of the mixture or solution necessitate emergency response measures that are different from those required for the substance identified by name in Table 3-1.

If b), c) or d) is applicable, the mixture or solution must be treated as a dangerous substance not specifically listed by name in Table 3-1.

Note. — Although traces of substances may not need to be taken into account for classification purposes, those traces may affect the properties of the substance and do need to be taken into account when considering the compatibility requirements contained in of Segment 4.

3.6 For a solution or mixture when the hazard class, the physical state or the packing group is changed in comparison with the listed substance, the appropriate n.o.s. entry must be used including its packaging and labelling provisions.

3.7 A mixture or solution containing one or more substances identified by name in Table 3-1 or classified under an n.o.s. entry and one or more substances not subject to these Technical Standardsis not subject to these Technical Standardsif the hazard characteristics of the mixture or solution are such that they do not meet the criteria (including human experience criteria) for any class.

3.8 Substances or articles which are not specifically listed by name in Table 3-1 must be classified under a “generic” or “n.o.s.” entry. The substance or article must be classified according to the class definitions and test criteria in this SEGMENT, and is then assigned the “generic” or “n.o.s.” entry in Table 3-1 which most appropriately describes the article or substance.[1] This means that a substance is to be assigned to an entry of type c), as defined in 3.2, only if it cannot be assigned to an entry of type b), and to an entry of type d) only if it cannot be assigned to an entry of type b) or c)[1].

3.9 A mixture or solution meeting the classification criteria of these Technical Standardsthat is not identified by name in Table 3-1 and that is composed of two or more dangerous goods must be assigned to an entry that has the proper shipping name, description, hazard class or division, subsidiary hazard(s) and packing group that most precisely describe the mixture or solution.

4. PRECEDENCE OF HAZARD CHARACTERISTICS

4.1 The precedence of hazards table (Table 2-1) must be used to determine the class of a substance, mixture or solution having more than one hazard, when it is not named in Table 3-1 or to assign the appropriate entry for articles containing dangerous goods n o.s (UN Nos. 3537 to 3548). For goods having multiple hazards, which are not specifically listed by name in Table 3-1, the most stringent packing group denoted to the respective hazards of the goods takes precedence over other packing groups, irrespective of Table 2-1. The correct class or division to be used is shown at the point at which the column and row intersect in Table 2-1. The correct packing group to be used is also shown at the point at which the column and row intersect. The precedence of hazard characteristics of the following have not been dealt with in Table 2-1, as the primary characteristics always take precedence:

a) substances and articles of Class 1;

b) gases of Class 2;

c) liquid desensitized explosives of Class 3;

d) self-reactive substances and solid desensitized explosives of Division 4.1;

e) pyrophoric substances of Division 4.2;

f) substances of Division 6.1 with a Packing Group I inhalation toxicity. Except for substances or preparations meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists (LC50) in the range of Packing Group I, but toxicity through oral ingestion or dermal contact only in the range of Packing Group III or less, which must be allocated to Class 8;

g) substances of Division 5.2;

h) substances of Division 6.2; and

i) material of Class 7.

4.2 Apart from radioactive material in excepted packages (where the other hazardous properties take precedence), radioactive material having other hazardous properties must always be classified in Class 7 and the subsidiary hazard must also be identified. For radioactive material in excepted packages, except for UN 3507, **Uranium hexafluoride, radioactive material, excepted package**, Special Provision A130 applies.

4.3 An article which, apart from its other hazards, also meets the criterion for magnetized material, must be identified in accordance with the provisions of this section and in addition as a magnetized material.

5. TRANSPORT OF SAMPLES

5.1 When the hazard class of a substance is uncertain and it is being transported for further testing, a tentative hazard class, proper shipping name and identification number must be assigned on the basis of the shipper's knowledge of the substance and application of:

a) the precedence of hazards given above.

b) the classification criteria of these Instructions; and

The highest level of danger of packing group possible for the shipping name chosen must be used.

5.2 Where this provision is used, the proper shipping name must be supplemented with the word "sample" (such as **Flammable liquid, n.o.s., sample**). In certain instances, where a specific proper shipping name is provided for a sample of a substance considered to meet certain classification criteria (such as **Gas sample, non-pressurized, flammable**, UN 3167), that proper shipping name must be used. When an n.o.s. entry is used to transport the sample, the proper shipping name need not be supplemented with the technical name.

5.3 Samples of the substance must be transported in accordance with the requirements applicable to the tentative assigned proper shipping name provided:

a) the substance is not considered to be a substance forbidden for transport by Segment 1;

b) the substance is not considered to meet the criteria for Class 1 or considered to be an infectious substance or a radioactive material;

c) the substance is in compliance with Segment 4 or 5, if it is a self-reactive substance or an organic peroxide, respectively;

d) the sample is transported in a combination packaging with a net mass per package that does not exceed 2.5 kg; and

e) the sample is not packed along with other goods.

5.4 Samples of energetic materials for testing purposes

Samples of organic substances carrying functional groups listed in tables A6.1 and/or A6.3 in Appendix 6 (Screening Procedures) of the UN *Manual of Tests and Criteria* may be transported under UN 3224 (self-reactive solid type C) or UN 3223 (self-reactive liquid type C), as applicable, of Division 4.1 provided that:

a) the samples do not contain any:

i) substances showing explosive effects in testing;

ii) compounds designed with the view of producing a practical explosive or pyrotechnic effect; or

iii) components consisting of synthetic precursors of intentional explosives;

iv) known explosives;

b) for mixtures, complexes or salts of inorganic oxidizing substances of Division 5.1 with organic material(s), the concentration of the inorganic oxidizing substance is:

i) less than 30 per cent, by mass, if assigned to Packing Group III (low hazard);

ii) less than 15 per cent, by mass, if assigned to Packing Group I (high hazard) or II (medium hazard); or

c) available data does not allow a more precise classification;

d) the sample is not packed together with other goods;

e) the sample is packed in accordance with Packing Instruction 459; and

f) the proper shipping name is supplemented with the word “sample”.

6. CLASSIFICATION OF ARTICLES AS ARTICLES CONTAINING DANGEROUS GOODS N.O.S.

6.0 Articles which do not have an existing proper shipping name, and which contain only dangerous goods as a residue or as an integral element of the machinery or apparatus must be classified as follows:

≠ a) where the dangerous goods meet the provisions of Packing Instruction 962: UN 3363 – **Dangerous goods in apparatus, Dangerous goods in articles** or **Dangerous goods in machinery**; or

b) where the net quantity of dangerous goods in the machinery or apparatus exceeds the limits of Packing Instruction 962 but contains dangerous goods permitted as limited quantities within the quantity limits specified in column 7(a) of the UN Model Regulations, see Special Provision A107; or

c) in accordance with requirements in this section, as applicable.

6.1 Articles containing dangerous goods may be classified as otherwise provided by these Technical Standardsunder the proper shipping name for the dangerous goods they contain or in accordance with this section. For the purposes of this section “article” means machinery, apparatus or other devices containing one or more dangerous goods (or residues thereof) that are an integral element of the article, necessary for its functioning and that cannot be removed for the purpose of transport. An inner packaging is not an article.

6.2 Such articles may in addition contain cells or batteries. Lithium cells and batteries that are integral to the article must be of a type proven to meet the testing requirements of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3. For articles containing pre-production prototype lithium cells or batteries transported for testing, or for articles containing lithium cells or batteries manufactured in production runs of not more than 100 cells or batteries, the requirements of Special Provision A88 apply (Pre-production prototypes of lithium cells or batteries, or sodium ion cells or batteries, when these protypes are transported for testing or low production runs of lithium cells or batteries, or sodium ion cells of batteries that have not been tested to the requirements in Part 111, subsection 38.3 of the UN Manual of Tests and criteria may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the Sate of the Operator and the requirements in Package instruction 910 of the supplement are met)

6.3 This section does not apply to articles for which a more specific proper shipping name already exists in Table 3-1.

6.4 This section does not apply to dangerous goods of Class 1, Division 6.2, Class 7 or radioactive material contained in articles. However, this section applies to articles containing explosives which are excluded from Class 1 in accordance with Segment 2.

6.5 Articles containing dangerous goods must be assigned to the appropriate class or division determined by the hazards present using, where applicable, Table 2-1 for each of the dangerous goods contained in the article. If dangerous goods classified as Class 9 are contained within the article, all other dangerous goods present in the article must be considered to present a higher hazard.

6.6 Subsidiary hazards must be representative of the primary hazard posed by the other dangerous goods contained within the article. When only one item of dangerous goods is present in the article, the subsidiary hazard(s), if any, is the subsidiary hazard(s) identified in column 4 of Table 3-1. If the article contains more than one item of dangerous goods and these could react dangerously with one another during transport, each of the dangerous goods must be enclosed separately.

Table 2-1. Precedence of hazards and packing groups for Classes 3, 4 and 8 and for Divisions 5.1 and 6.1

Class or division and packing group	*Class or division and packing group*																	
	4.2 II	4.2 III	4.3 I	4.3 II	4.3 III	5.1 I	5.1 II	5.1 III	6.1 I (d)	6.1 I (o)	6.1 II	6.1 III	8 I (l)	8 I (s)	8 II (l)	8 II (s)	8 III (l)	8 III (s)
3 I*			4.3,I	4.3,I	4.3,I	–	–	–	3,I	3,I	3,I	3,I	3,I	–	3,I	–	3,I	–
3 II*			4.3,I	4.3,II	4.3,II	–	–	–	3,I	3,I	3,II	3,II	8,I	–	3,II	–	3,II	–
3 III*			4.3,I	4.3,II	4.3,III	–	–	–	6.1,I	6.1,I	6.1,II	3,III**	8,I	–	8,II	–	3,III	–
4.1 II*	4.2,II	4.2,II	4.3,I	4.3,II	4.3,II	5.1,I	4.1,II	4.1,II	6.1,I	6.1,I	4.1,II	4.1,II	–	8,I	–	4.1,II	–	4.1,II
4.1 III*	4.2,II	4.2,III	4.3,I	4.3,II	4.3,III	5.1,I	4.1,II	4.1,III	6.1,I	6.1,I	6.1,II	4.1,III	–	8,I	–	8,II	–	4.1,III
4.2 II			4.3,I	4.3,II	4.3,II	5.1,I	4.2,II	4.2,II	6.1,I	6.1,I	4.2,II	4.2,II	8,I	8,I	4.2,II	4.2,II	4.2,II	4.2,II
4.2 III			4.3,I	4.3,II	4.3,III	5.1,I	5.1,II	4.2,III	6.1,I	6.1,I	6.1,II	4.2,III	8,I	8,I	8,II	8,II	4.2,III	4.2,III
4.3 I						5.1,I	4.3,I	4.3,I	6.1,I	4.3,I	4.3,I	4.3,I	4.3,I	4.3,I	4.3,I	4.3,I	4.3,I	4.3,I
4.3 II						5.1,I	4.3,II	4.3,II	6.1,I	4.3,I	4.3,II	4.3,II	8,I	8,I	4.3,II	4.3,II	4.3,II	4.3,II
4.3 III						5.1,I	5.1,II	4.3,III	6.1,I	6.1,I	6.1,II	4.3,III	8,I	8,I	8,II	8,II	4.3,III	4.3,III
5.1 I									5.1,I	5.1,I	5.1,I	5.1,I	5.1,I	5.1,I	5.1,I	5.1,I	5.1,I	5.1,I
5.1 II									6.1,I	5.1,I	5.1,II	5.1,II	8,I	8,I	5.1,II	5.1,II	5.1,II	5.1,II
5.1 III									6.1,I	6.1,I	6.1,II	5.1,III	8,I	8,I	8,II	8,II	5.1,III	5.1,III
6.1 I (d)													8,I	6.1,I	6.1,I	6.1,I	6.1,I	6.1,I
6.1 I (o)													8,I	6.1,I	6.1,I	6.1,I	6.1,I	6.1,I
6.1 II (i)													8,I	6.1,I	6.1,II	6.1,II	6.1,II	6.1,II
6.1 II (d)													8,I	6.1,I	8,II	6.1,II	6.1,II	6.1,II
6.1 II (o)													8,I	8,I	8,II	6.1,II	6.1,II	6.1,II
6.1 III													8,I	8,I	8,II	8,II	8,III	8,III

(l) = liquid; (s) = solid; (i) = inhalation; (d) = dermal; (o) = oral; – denotes an impossible combination

* Substances of Division 4.1 other than self-reactive substances, and solid desensitized explosives and substances of Class 3 other than liquid desensitized explosives.

** For pesticides only, the primary hazard must be Division 6.1.

Note.— For hazards not shown in this table, see 4.

Section 1 CLASS 1 – EXPLOSIVES

Note 1. Class 1 is a restricted class, that is, only those explosive substances and articles that are listed in the Dangerous Goods List may be accepted for transport. However, the appropriate authorities of the States concerned retain the right by mutual agreement to approve transport of explosive substances and articles for special purposes under special conditions. Therefore, entries have been included in the Dangerous Goods List for "Substances, explosive, n.o.s." and "Articles, explosive, n.o.s.". It is intended that these entries be used only when no other method of operation is possible.

Note 2. General entries, such as "Explosive, blasting, Type A", are used to allow for the transport of new substances. In preparing these requirements, military ammunition and explosives have been taken into consideration to the extent that they are likely to be transported by civil aircraft.

Note 3. A number of substances and articles which are in Class 1 are described in Attachment 2 to these Instructions. These descriptions are given because a term may not be well known or may be at variance with its usage for regulatory purposes.

Note 4. Class 1 is unique in that the type of packaging frequently has a decisive effect on the hazard and therefore on the assignment to a particular division. The correct division is determined by use of the procedures provided in this Section.

Note 5. Most of the explosives listed in Table 3-1 are not normally permitted for transport by air. Information concerning these explosives is included in Table 3-1 and in the Supplement to these Technical Standardsto provide guidance for States in those cases where consideration is being given to granting exemptions in accordance with 1;1.1.3. The following instances are applicable to approvals, if an overall level of equivalent safety is achieved.

- Extreme emergency
- When other forms of transport are inappropriate
- When full compliance with the prescribed requirements is contrary to the public interest

1.1 DEFINITIONS AND GENERAL PROVISIONS

Class 1 comprises:

a) explosive substances (a substance that is not itself an explosive, but which can form an explosive atmosphere of gas, vapour or dust is not included in Class 1), except those that are too dangerous to transport or those where the predominant hazard is appropriate to another class;

b) explosive articles, except devices containing explosive substances in such quantity or of such character that their inadvertent or accidental ignition or initiation during transport will not cause any external effect to the device either by projection, fire,

smoke, heat or loud noise; and

c) substances and articles not mentioned under 1.1 a) and b), which are manufactured with a view to producing a practical explosive or pyrotechnic effect.

1.2 DEFINITIONS

For the purposes of these Instructions, the following definitions apply:

a) ***Explosive substance***

Is a solid or liquid substance (or a mixture of substances) which is in itself capable, by chemical reaction, of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. Pyrotechnic substances are included even when they do not evolve gases.

b) ***Explosive article***

is an article containing one or more explosive substances.

c) ***Phlegmatized***

means that a substance (or "phlegmatizer") has been added to an explosive to enhance its safety in handling and transport. The phlegmatizer renders the explosive insensitive, or less sensitive, to the following actions: heat, shock, impact, percussion or friction. Typical phlegmatizing agents include, but are not limited to: paper, wax, water, polymers (such as chlorofluoropolymers), alcohol and oils (such as petroleum jelly and paraffin).

+ e) ***Explosive or pyrotechnic effect***

means, in the context of 1.1 c), an effect produced by self-sustaining exothermic chemical reactions including shock, blast, fragmentation, projection, heat, light, sound, gas and smoke.

f) ***Pyrotechnic substance***

is an explosive substance designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative, self-sustaining, exothermic, chemical reactions.

1.3 DIVISIONS

1.3.1 Class 1 is divided into six divisions:

a) Division 1.1 – Substances and articles which have a mass explosion hazard (a mass explosion is one which affects almost the entire load virtually instantaneously).

b) Division 1.2 – Substances and articles which have a projection hazard but not a mass explosion hazard.

c) Division 1.3 – Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

This division comprises substances and articles which:

i) burn one after another, producing minor blast or projection effects or both.

ii) give rise to considerable radiant heat, or

d) Division 1.4 – Substances and articles which present no significant hazard.

This division comprises substances and articles which:

- present only a small hazard in the event of ignition or initiation during transport.
- The effects are largely confined to the package, and no projection of fragments of appreciable size or range is to be expected.
- An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Note. — Substances and articles of this division are in Compatibility Group S if they are so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package, unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder fire fighting or other emergency response efforts in the immediate vicinity of the package.

e) Division 1.5 – Very insensitive substances which have a mass explosion hazard.

This division comprises substances which;

- have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Note. — For the normal conditions of transport, see Notes 2 to 4 of the Introductory Notes to SEGMENT 4.

f) Division 1.6 – Extremely insensitive articles which do not have a mass explosion hazard.

This division comprises articles which;

- predominantly contain extremely insensitive substances and which demonstrate a negligible probability of accidental initiation or propagation.

Note. — The hazard from articles of Division 1.6 is limited to the explosion of a single article.

1.3.2 Any substance or article having or suspected of having explosive characteristics must first be considered for classification in Class 1 in accordance with the procedures in 1.5.1.1 to 1.5.1.3. Goods are not classified in Class 1 when:

a) unless specially authorized, the transport of an explosive substance is forbidden because sensitivity of the substance is excessive;

b) the substance or article has no explosive properties

c) the substance or article comes within the scope of those explosive substances and articles which are specifically excluded from Class 1 by the definition of this class; or

1.4 COMPATIBILITY GROUPS

1.4.1 Goods of Class 1 are assigned to one of six divisions, depending on the type of hazard they present (see 1.3.1), and to one of thirteen compatibility groups which identify the kinds of explosive substances and articles that are deemed to be compatible. Tables 2-2 and 2-3 show the scheme of classification into compatibility groups, the possible hazard divisions associated with each group, and the consequential classification codes.

1.4.2 The definitions of compatibility groups in Table 2-2 are intended to be mutually exclusive, except for a substance or article which qualifies for Compatibility Group S. Since the criterion of Compatibility Group S is an empirical one, assignment to this group is necessarily linked to the tests for assignment to Division 1.4.

1.4.2.1 Certain Division 1.4S explosives, identified by Special Provision A165 in Table 3-1, are subject to Test Series 6 (d) of SEGMENT I of the UN *Manual of Tests and Criteria* to demonstrate that any hazardous effects arising from functioning are confined within the package. Evidence of a hazardous effect outside the package includes:

a) denting or perforation of the witness plate beneath the package;

b) a flash or flame capable of igniting such as a sheet of 80 ± 3 g/m² paper at a distance of 25 cm from the package;

c) disruption of the package causing projection of the explosives contents; or

d) a projection which passes completely through the packaging (a projection or fragment retained or stuck in the wall of the packaging is considered as non-hazardous).

The appropriate national authority may wish to take into account the expected effect of the initiator when assessing the results of the test, if these are expected to be significant when compared to the articles being tested. If there are hazardous effects outside the package, then the product is excluded from Compatibility Group S.

Table 2-2. Classification codes

Description of Substance or Article to be classified	*Classification code*	*Compatibility code*
Primary explosive substance	1.1A	A
Article containing a primary explosive substance and not containing two or more effective protective features. Some articles, such as detonators for blasting, detonator assemblies for blasting and primers, cap-type, are included even though they do not contain primary explosives	1.1B 1.2B 1.4B	B
Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance	1.1C 1.2C 1.3C 1.4C	C
Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features	1.1D 1.2D 1.4D 1.5D	D
Article containing a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids)	1.1E 1.2E 1.4E	E
Article containing a secondary detonating explosive substance with its own means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids) or without a propelling charge	1.1F 1.2F 1.3F 1.4F	F
Pyrotechnic substance, or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear- or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphides, a pyrophoric substance, a flammable liquid or gel, or hypergolic liquids)	1.1G 1.2G 1.3G 1.4G	G
Article containing both an explosive substance and white phosphorus	1.2H 1.3H	H
Article containing both an explosive substance and a flammable liquid or gel	1.1J 1.2J 1.3J	J
Article containing both an explosive substance and a toxic chemical agent	1.2K 1.3K	K

Description of substance or article to be classified	*Classification Code*	*Compatibility code*
Explosive substance or article containing an explosive substance and presenting a special hazard (such as due to water activation or presence of hypergolic liquids, phosphides or a pyrophoric substance) and needing isolation of each type	1.1L 1.2L 1.3L	L N S
Articles predominantly containing extremely insensitive substances		
Substances or articles so packed or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit fire fighting or other emergency response in the immediate vicinity of the package		
Note 1. — Articles of Compatibility Groups D and E may be fitted or packed together with their own means of initiation provided that such means have at least two effective protective features designed to prevent an explosion in the event of accidental functioning of the means of initiation. Such articles and packages must be assigned to Compatibility Groups D or E. *Note 2. — Articles of Compatibility Groups D and E may be packed together with their own means of initiation, which do not have two effective protective features when, in the opinion of the appropriate national authority of the State of Origin, the accidental functioning of the means of initiation does not cause the explosion of an article under normal conditions of transport. Such packages must be assigned to Compatibility Groups D or E.*		

Table 2-3. Scheme of classification of explosives, combination of hazard division with compatibility group

	Compatibility Group													
Hazard	A	B	C	D	E	F	G	H	J	K	L	N	S	A-S Σ
1.1	1.1A	1.1B	1.1C	1.1D	1.1E	1.1F	1.1G		1.1J		1.1L			9
1.2		1.2B	1.2C	1.2D	1.2E	1.2F	1.2G	1.2H	1.2J	1.2K	1.2L			10
1.3			1.3C			1.3F	1.3G	1.3H	1.3J	1.3K	1.3L			7
1.4		1.4B	1.4C	1.4D	1.4E	1.4F	1.4G						1.4S	7
1.5				1.5D										1
1.6												1.6N		1
1.1-1.6 Σ		3	4	4	3	4	4	2	3	2	3	1	1	35

1.5 CLASSIFICATION OF EXPLOSIVES

Note.— For additional information regarding classification of explosives, see UN Recommendations.

1.5.1.1 Any substance or article having or suspected of having explosive characteristics must be considered for classification in Class 1 in accordance with the tests, procedures and criteria prescribed in Part I of the *UN Manual of Tests and Criteria*. Substances and articles classified in Class 1 must be assigned to the appropriate division and compatibility group in accordance with the procedures and criteria prescribed in that document.

1.5.1.2 The classification of fireworks must be based on the UN Recommendations.

1.5.1.3 Except for substances that are listed by their proper shipping name in the Dangerous Goods List (Table 3-1), goods must not be offered for transport as Class 1 until they have been subjected to the classification procedure prescribed in this Section. In addition, the classification procedure must be undertaken before a new product is offered for transport. In this context, a new product is one which, in the opinion of the appropriate national authority, involves any of the following:

a) a new design of article or an article containing a new explosive substance or a new combination or mixture of explosive substances;

b) a new design of package for an explosive substance or article including a new type of inner packaging.

c) a new explosive substance or a combination or a mixture of explosive substances which is considered to be significantly different from other combinations or mixtures already classified;

Note. — The importance of this can be overlooked unless it is realized that a relatively minor change in an inner or outer packaging can be critical and can convert a lesser hazard into a mass explosion hazard.

1.5.1.4 The producer or other applicant for classification of the product must provide adequate information concerning the names and characteristics of all explosive substances in the product and must furnish the results of all relevant tests which have been done. It is assumed that all the explosive substances in a new article have been properly tested and then approved.

1.5.2 Exclusion from Class 1

1.5.2.1 The appropriate national authority may exclude an article or substance from Class 1 by virtue of test results and the Class 1 definition.

1.5.2.2 Where a substance provisionally accepted into Class 1 is excluded from Class 1 by performing Test Series 6 on a specific type and size of package, this substance, when meeting the classification criteria or definition for another class or division, should be listed in the Dangerous Goods List in that class or division with a special provision restricting it to the type and size of package tested.

1.5.2.3 Where a substance is assigned to Class 1 but is diluted to be excluded from

Class 1 by Test Series 6, this diluted substance (hereafter referred to as desensitized explosive) should be listed in the Dangerous Goods List with an indication of the highest concentration which excluded it from Class 1-Liquid desensitized explosives are explosive substances which are dissolved or suspended in water or other liquid substances, to form a homogenous liquid mixture to suppress their explosive properties. Entries in the Dangerous Goods List (Table 3-1) for liquid desensitized explosives are UN 1204, UN 2059, UN3064, UN3343, UN3357, UN 3379 and UN3555 and if applicable, the concentration below which it is no longer deemed subject to these Instructions. New solid desensitized explosives subject to these Technical Standards should be listed in Division 4.1, and new liquid desensitized explosives should be listed in Class 3. When the desensitized explosive meets the criteria or definition for another class or division, the corresponding subsidiary hazard(s) should be assigned to it.

1.5.2.4 An article may be excluded from Class 1 when three unpackaged articles, each individually activated by its own means of initiation or ignition or external means to function in the designed mode, meet the following test criteria:

a) no external surface has a temperature of more than 65ºC. A momentary spike in temperature up to 200ºC is acceptable;

b) no rupture or fragmentation of the external casing or movement of the article or detached SEGMENTs thereof of more than one metre in any direction;

Note. — Where the integrity of the article may be affected in the event of an external fire, these criteria must be examined by a fire test. One such method is described in ISO 14451-2 using a heating rate of 80 K/min.

c) no audible report exceeding 135 dB(C) peak at a distance of one metre;

d) no production of smoke, fumes or dust in such quantities that the visibility in a one cubic metre chamber equipped with appropriately sized blow out panels is reduced more than 50 per cent as measured by a calibrated light (lux) meter or radiometer located one metre from a constant light source located at the midpoint on opposite walls. The general guidance on optical density testing in ISO 5659-1 and the general guidance on the photometric system described in Section 7.5 in ISO 5659-2 may be used or similar optical density measurement methods designed to accomplish the same purpose may also be employed. A suitable hood cover surrounding the back and sides of the light meter must be used to minimize effects of scattered or leaking light not emitted directly from the source.

e) no flash or flame capable of igniting a material such as a sheet of 80 ± 10 g/m² paper in contact with the article; and

Note 1. — If during the tests addressing criteria a), b), c) and d), no smoke, or very little smoke is observed, the test described in e) may be waived.

Note 2. — The appropriate national authority may require testing in packaged form if it is determined that, as packaged for transport, the article may pose a greater hazard.

1.5.3 Classification documentation

1.5.3.1 An appropriate national authority assigning an article or substance into Class 1 should confirm with the applicant that classification in writing.

1.5.3.2 An appropriate national authority classification document may be in any form and may consist of more than one page, provided pages are numbered consecutively. The document should have a unique reference.

1.5.3.3 The information provided must be easy to identify, legible and durable.

1.5.3.4 Examples of the information that may be provided in the classification documents are as follows:

a) the name of the appropriate national authority and the provisions in national legislation under which it is granted its authority;

b) the modal or national regulations for which the classification document is applicable;

c) confirmation that the classification has been approved, made or agreed in accordance with the UN Model Regulations or these Instructions;

d) the name and address of the person in law to which the classification has been assigned and any company registration which uniquely identifies a company or other body corporate under national legislation;

e) the name under which the explosives will be placed onto the market or otherwise supplied for transport;

f) the proper shipping name, UN number, class, hazard division and corresponding compatibility group of the explosives;

g) where appropriate, the maximum net explosive mass of the package or article;

h) the name, signature, stamp, seal or other identification of the person authorized by the appropriate national authority to issue the classification document is clearly visible;

i) where safety in transport or the hazard division is assessed as being dependent upon the packaging, the packaging mark or a description of the permitted:

   i) inner packagings;

   ii) intermediate packagings; and

   iii) outer packagings;

j) the classification document states the part number, stock number or other identifying reference under which the explosives will be placed onto the market or otherwise supplied for transport;

k) the name and address of the person in law who manufactured the explosives and any company registration which uniquely identifies a company or other body corporate under national legislation;

l) any additional information regarding the applicable packing instruction and special packing

provisions where appropriate;

m) any special conditions or limitations that the appropriate national authority has identified as relevant to the safety for transport of the explosives, the communication of the hazard and international transport; and

n) the expiry date of the classification document is given where the appropriate national authority considers one to be appropriate

o) the basis for assigning the classification, that is, whether on the basis of test results, default for fireworks, analogy with classified explosive, by definition from the Dangerous Goods List, etc.;

Section 2

CLASS 2 – GASES

2.1 DEFINITIONS AND GENERAL PROVISIONS

2.1.1 A gas is a substance which:

a) at 50°C has a vapour pressure greater than 300 kPa; or

b) is completely gaseous at 20°C at a standard pressure of 101.3 kPa.

2.1.2 The transport condition of a gas is described according to its physical state as:

a) compressed gas – a gas which when packaged under pressure for transport is entirely gaseous at –50°C; this category includes all gases with a critical temperature less than or equal to –50°C;

b) adsorbed gas – a gas which when packaged for transport is adsorbed onto a solid porous material resulting in an internal receptacle pressure of less than 101.3 kPa at 20°C and less than 300 kPa at 50°C.

c) liquefied gas – a gas which when packaged under pressure for transport is partially liquid at temperatures above –50°C. A distinction is made between:

High pressure liquefied gas: a gas with a critical temperature between –50°C and +65°C, and

Low pressure liquefied gas: a gas with a critical temperature above +65°C;

d) refrigerated liquefied gas – a gas which when packaged for transport is made partially liquid because of its low temperature;

e) dissolved gas – a gas which when packaged under pressure for transport is dissolved in a liquid phase solvent; or

2.1.3 This class comprises compressed gases; liquefied gases; dissolved gases; refrigerated liquefied gases; mixtures of one or more gases with one or more vapours of substances of other classes; articles charged with a gas, aerosols and chemicals under pressure. (For aerosols, see 1;3.1.)

Note. —"Cryogenic liquid" means the same as "refrigerated liquefied gas".

2.1.4 Pressures of all kinds relating to receptacles (such as test pressure, internal pressure, safety-valve opening pressure) are always indicated in gauge pressure (pressure in excess of atmospheric pressure); however, the vapour pressure of substances is always expressed in absolute pressure.

2.2 DIVISIONS

2.2.1 Substances of Class 2 are assigned to one of three divisions based on the primary hazard of the gas during transport.

*Note. — UN 1950 – **Aerosols,** UN 2037 – **Receptacles, small, containing gas** and UN 2037 – **Gas cartridges** must be regarded as being in Division 2.1 when the criteria in 2.5.1 a) are met. For chemicals under pressure of UN Nos. 3500 to 3505, see Special Provision A187.*

a) **Division 2.1 – Flammable gases.**

Gases which at 20°C and a standard pressure of 101.3 kPa:

i) are ignitable when in a mixture of 13 per cent or less by volume with air; or

ii) have a flammable range with air of at least 12 percentage points regardless of the lower flammable limit. Flammability must be determined by tests or by calculation in accordance with methods adopted by ISO (see ISO 10156:2017). Where insufficient data are available to use these methods, tests by a comparable method recognized by the appropriate national authority must be used.

b) **Division 2.2 – Non-flammable,**

non-toxic gases. Gases which:

i) are asphyxiant – gases which dilute or replace the oxygen normally in the atmosphere; or

ii) do not come under the other divisions.

iii) are oxidizing – gases which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does; or

Note. — "gases which cause or contribute to the combustion of other material more than air does" means pure gases or gas mixtures with an oxidizing power greater than 23.5 per cent as determined by a method specified in ISO 10156:2017.

c) **Division 2.3 – Toxic gases.**

Gases which:

i) are known to be so toxic or corrosive to humans as to pose a hazard to health; or

ii) are presumed to be toxic or corrosive to humans because they have an LC_{50} value equal to or less than 5 000 mL/m^3 (ppm) when tested in accordance with Segment 6.

Note. — Gases meeting the above criteria owing to their corrosivity are to be classified as toxic with a subsidiary corrosive hazard.

2.2.2 Gases of Division 2.2 are not subject to these Technical Standardsif they are transported at a pressure less than 200 kPa at 20°C and are not liquefied or refrigerated liquefied gases.

2.2.3 Gases of Division 2.2 are not subject to these Technical Standardswhen contained in the following:

a) foodstuffs, including carbonated beverages (except UN 1950);

b) balls intended for use in sports; or

c) tyres which meet the provisions of Special

Provision A59. Note.— This exception does not

apply to lamps. For lamps see Segment 1.

2.3 HAZARD PRECEDENCE

Gases and gas mixtures with hazards associated with more than one division take the following precedence:

a) Division 2.3 takes precedence over all other divisions;

b) Division 2.1 takes precedence over Division 2.2.

2.4 MIXTURES OF GASES

For the classification of gas mixtures into one of the three divisions (including vapours of substance from other classes), the following principles must be used:

a) Flammability must be determined by tests or by calculation in accordance with methods adopted by ISO (see ISO 10156:2017). Where insufficient data are available to use these methods, tests by a comparable method recognized by the appropriate national authority may be used.

b) The level of toxicity is determined by either tests in accordance with Segment 6 or a calculation method using the following formula:

$$LC_{50}\text{Toxic (mixture)} = \frac{1}{\sum_{i=1} \frac{f_i}{T_i}}$$

- where f_i = mole fraction of the i^{th} component substance of the mixture, and
- where T_i = toxicity index of the i^{th} component substance of the mixture (the T_i equals the LC_{50} value when available).

When LC_{50} values are unknown, the toxicity index is determined by using the lowest LC_{50} value of substances of similar physiological and chemical effects, or through testing if this

is the only practical possibility.

c) A gas mixture has a subsidiary hazard of corrosivity when the mixture is known by human experience to be destructive to the skin, eyes or mucous membranes or when the LC_{50} value of the mixture's corrosive components is equal to or less than 5 000 mL/m^3 (ppm) when the LC_{50} value is calculated by the formula:

$$LC_{50}\text{Corrosive (mixture)} = \frac{1}{\sum_{i=1}^{n} \frac{f_{ci}}{T_{ci}}}$$

- where f_{ci} = mole fraction of the i^{th} corrosive component substance of the mixture, and
- where T_{ci} = Toxicity index of the i^{th} corrosive component substance of the mixture (the T_{ci} equals the LC_{50} value when available).

d) Oxidizing ability is determined either by tests or by calculation methods adopted by the International Standards Organization and ISO 10156:2017).

2.5 AEROSOLS

2.5.1 For aerosols, the division of Class 2 and the subsidiary hazards depend on the nature of the contents of the aerosol dispenser. The following provisions must apply:

a) Division 2.1 applies if the contents include 85 per cent by mass or more flammable components and the chemical heat of combustion is 30 kJ/g or more;

b) Division 2.2 applies if the content contains 1 per cent by mass or less flammable components and the heat of combustion is less than 20 kJ/g;

c) Otherwise, the product must be classified as tested by the tests described in the UN *Manual of Tests and Criteria*, Part III, section 31. Extremely flammable and flammable aerosols must be classified in Division 2.1; non-flammable in Division 2.2;

d) gases of Division 2.3 must not be used as propellant in an aerosol dispenser;

e) where the contents other than the propellant of aerosol dispensers to be ejected are classified as Division 6.1, Packing Groups II or III or Class 8, Packing Groups II or III, the aerosol must have a subsidiary hazard of Division 6.1 or Class 8;

f) aerosols with contents meeting the criteria of Packing Group I for toxicity or corrosivity are forbidden from transport.

2.5.2 Flammable components are flammable liquids, flammable solids or flammable gases and gas mixtures as defined in Notes 1 to 3 of subsections 31.1.3 of SEGMENT III of the UN *Manual of Tests and Criteria*. This designation does not cover;

- pyrophoric,

- self-heating
- water-reactive substances.

  The chemical heat of combustion must be determined by one of the following methods: ASTM D 240, ISO/FDIS 13943: 1999 (E/F) 86.1 to 86.3 or NFPA 30B.

2.6 GASES FORBIDDEN FOR TRANSPORT

Chemically unstable gases of Class 2 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization. When chemical stabilization is employed, the person offering the packaging for transport, must ensure that the level of stabilization is sufficient to prevent the substance in the packaging from dangerous polymerization at a bulk mean temperature of 50*C. Where chemical stabilization becomes ineffective at lower temperatures within the anticipated duration of transport, temperature control is required in which case the substances are forbidden for transport To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

Section 3

CLASS 3 – FLAMMABLE LIQUIDS

INTRODUCTORY NOTES

Note 1.— The word "flammable" has the same meaning as "inflammable".

Note 2.— The flash point of a flammable liquid may be altered by the presence of an impurity. The substances listed in Class 3 in the Dangerous Goods List in SEGMENT 3 must generally be regarded as chemically pure. Since commercial products may contain added substances or impurities, flash points may vary, and this may have an effect on classification or determination of the packing group for the product. In the event of doubt regarding the classification or packing group of a substance, the flash point of the substance must be determined experimentally.

3.1 DEFINITION AND GENERAL PROVISIONS

3.1.1 Class 3 includes the following substances:

a) Flammable liquids;

b) Liquid desensitized explosives.

3.1.2 Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension (for example paints, varnishes, lacquers, etc., but not including substances otherwise classified on account of their dangerous characteristics) which give off a flammable vapour at temperatures of not more than 60°C, closed-cup test, or not more than 65.6°C, open-cup test, normally referred to as the flash point. This class also includes:

a) liquids offered for transport at temperatures at or above their flash point; and

b) substances that are transported or offered for transport at elevated temperatures in a liquid state and which give off a flammable vapour at a temperature at or below the maximum transport temperature (that is, the maximum temperature likely to be encountered by the substance in transport).

Note. — Since the results of open-cup tests and of closed-cup tests are not strictly comparable and even individual results by the same test are often variable, regulations varying from the above figures to make allowance for such differences would be within the spirit of this definition.

3.1.3 Liquids meeting the definition in 3.1.2 above with a flash point of more than 35°C which do not sustain combustion need not be considered as flammable liquids for the purposes of these Instructions. Liquids are considered to be unable to sustain combustion for the purposes of these Technical Standards(that is, they do not sustain combustion under defined test conditions) if:

a) they have passed a suitable combustibility test (see Sustained Combustibility Test

prescribed in the UN *Manual of Tests and Criteria*, Part III, subsection 32.5.2); or

b) they are miscible solutions with a water content of more than 90 per cent by mass.

c) their fire point according to ISO 2592:2000 is greater than 100°C; or

3.1.4 Liquid desensitized explosives are explosive substances which are dissolved or suspended in water or other liquid substances, to form homogeneous liquid mixture to suppress their explosive properties. Entries in the Dangerous Goods List (Table 3-1) for liquid desensitized explosives are: UN 1204, UN 2059, UN 3064, UN 3343, UN 3357, UN 3379 and UN 3555.

3.2 ASSIGNMENT OF PACKING GROUPS

3.2.1 Table 2-4 should be used for the determination of the packing group of a liquid that presents a hazard due to flammability. For liquids whose only hazard is flammability, the packing group for the liquid is the packing group shown in Table 2-4. For a liquid possessing an additional hazard(s), the packing group, determined by using Table 2-4, and the packing group based on the severity of the additional hazard(s), must be considered. In such cases, the table of precedence of hazard characteristics appearing in Table 2-1 should be used to determine the correct classification of the liquid.

3.2.2 Viscous flammable liquids such as paints, enamels, lacquers, varnishes, adhesives and polishes having a flash point of less than 23°C may be assigned to Packing Group III in conformity with the procedures prescribed in Part III, subsection 32.3 of the UN *Manual of Tests and Criteria* provided that:

a) the viscosity[2] and flash point are in accordance with Table 2-5;

b) less than 3 per cent of the clear solvent layer separates in the solvent separation test;

c) the mixture or any separated solvent does not meet the criteria for Division 6.1 or Class 8;

d) the net quantity per package does not exceed 30 L for passenger aircraft or 100 L for cargo aircraft.

3.2.3 Substances classified as flammable liquids due to their being transported or offered for transport at elevated temperatures are included in Packing Group III.

Table 2-4. Packing group based on flammability

Flash Point (Closed cup)	*Packing group*	*Initial boiling point*
-	I	≤35°C
≤23°C	II	>35°C
≥23°C, ≤60°C	III	>35°C

Table 2-5. Viscosity and flashpoints

Kinematic viscosity (extrapolated) v (at near-zero shear rate) mm^2/s at 23°C	*Flow time t in seconds*	*Flash point in °C (closed cup)*	*Jet diameter in mm*
$20 < v \leq 80$	$20 < t \leq 60$	above 17	4
$80 < v \leq 135$	$60 < t \leq 100$	above 10	4
$135 < v \leq 220$	$20 < t \leq 32$	above 5	6
$220 < v \leq 300$	$32 < t \leq 44$	above –1	6
$300 < v \leq 700$	$44 < t \leq 100$	above –5	6
$700 < v$	$100 < t$	–5 and below	6

3.3 DETERMINATION OF FLASH POINT

The following methods for determining the flash point of flammable liquids may be used:

International standards

- **ISO 1516**
- **ISO 1523**
- **ISO 2719**
- **ISO 13736**
- **ISO 3679**
- **ISO 3680**

National standards

American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959

– ASTM D-3828-93, Standard Test Methods for Flash Point by Small Scale Closed Tester
– ASTM D-56-93, Standard Test Method for Flash Point by Tag Closed Tester

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2. Viscosity determination: Where the substance concerned is non-Newtonian, or where a flow cup method of viscosity determination is otherwise unsuitable, a variable shear-rate viscometer must be used to determine the dynamic viscosity coefficient of the substance, at 23°C, at a number of shear rates. The values obtained are plotted against shear rate and then extrapolated to zero shear rate. The dynamic viscosity thus obtained, divided by the density, gives the apparent kinematic viscosity at near-zero shear rate.

— ASTM D-3278-96, Standard Test Methods for Flash Point of Liquids by Setaflash Closed-Cup Apparatus
— ASTM D-0093-96, Standard Test Methods for Flash Point by Pensky-Martens Closed-Cup Tester.

Association française de normalisation, AFNOR, 11, rue Francis de Pressensé, 93571 La Plaine Saint-Denis Cedex, France

— French Standard NF M 07–019
— French Standards NF M 07–011 / NF T 30–050 / NF T 66–009
— French Standard NF M 07–036

Deutsches Institut für Normung, Burggrafenstrasse 6, D-10787 Berlin

— Standard DIN 51755 (flash points below 65°C)

State Committee of the Council of Ministers for Standardization, 113813, GSP, Moscow, M-49 Leninsky Prospect, 9

— GOST 12.1.044-84

3.4 DETERMINATION OF INITIAL BOILING POINT

The following methods for determining the initial boiling point of flammable liquids may be used:

International standards

- **ISO 3924**
- **ISO 4626**
- **ISO 3405**

National standards

American Society for Testing Materials International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959

— ASTM D-86-07a, Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure
— ASTM D-1078-05, Standard Test Method for Distillation Range of Volatile Organic Liquids

Further acceptable methods

— Method A.2 as described in SEGMENT A of the Annex to Commission Regulation (EC) No 440/2008[3]

3.5 SUBSTANCES FORBIDDEN FOR TRANSPORT

Chemically unstable substances of Class 3 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization. When chemical stabilization is employed, the person offering the packaging for transport, must ensure that the level of stabilization is sufficient to prevent the substance in the packaging from dangerous polymerization at a bulk mean temperature of 50*C. Where chemical stabilization becomes ineffective at lower temperatures within the

anticipated duration of transport, temperature control is required in which case the substances are forbidden for transport To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions To this end, Segmenticular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

3. Commission Regulation (EC) No 440/2008 of 30 May 2008 laying down test methods pursuant to Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Official Journal of the European Union, No. L 142 of 31.05.2008, p.1-739 and No. L 143 of 03.06.2008, p.55).

Section 4

CLASS 4 – FLAMMABLE SOLIDS; SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION; SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

INTRODUCTORY NOTES

Note 1. — Where the term "water-reactive" is used in these Instructions, it refers to a substance which, in contact with water, emits flammable gas.

Note 2. — Since organometallic substances can be classified in Divisions 4.2 or 4.3 with additional subsidiary hazards, depending on their properties, a specific classification flowchart for these substances is given in 2.4.5 of the UN Recommendations on the Transport of Dangerous Goods.

Note 2. — Because of the different properties exhibited by the dangerous goods within Divisions 4.1 and 4.2, it is impracticable to establish a single criterion for classification in either of these divisions. Tests and criteria for assignment to the three divisions of Class 4 are addressed in this Section and in the UN Manual of Tests and Criteria, *Part III, section 33.*

4.1 DEFINITIONS AND GENERAL PROVISIONS

4.1.1 Class 4 is divided into three divisions as follows:

a) Division 4.1 – Flammable solids.

Solids which, under conditions encountered in transport, are readily combustible or may cause or contribute to fire through friction; self-reactive substances and polymerizing substances which are liable to undergo a strongly exothermic reaction; desensitized explosives which may explode if not diluted sufficiently.

b) Division 4.2 – Substances liable to spontaneous combustion.

Substances which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up in contact with air, and being then liable to catch fire.

c) Division 4.3 – Substances which, in contact with water, emit flammable gases.

Substances which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

4.1.2 As referenced in this Section, test methods and criteria, with advice on application of the tests, are given in the current edition of the UN *Manual of Tests and Criteria*, for the

classification of the following types of substances of Class 4:

a) Flammable solids (Division 4.1);

b) Self-reactive substances (Division 4.1);

c) Polymerizing substances (Division 4.1);

d) Pyrophoric solids (Division 4.2);

e) Pyrophoric liquids (Division 4.2);

f) Self-heating substances (Division 4.2); and

g) Substances which, in contact with water, emit flammable gases (Division 4.3).

Test methods and criteria for self-reactive substances and polymerizing substances are given in Part II of the UN *Manual of Tests and Criteria*, and test methods and criteria for the other types of substances of Class 4 are given in Part III, section 33 of the UN *Manual of Tests and Criteria*.

4.2 FLAMMABLE SOLIDS, SELF-REACTIVE SUBSTANCES, DESENSITIZED EXPLOSIVES AND POLYMERIZING SUBSTANCES

4.2.1 General

Division 4.1 includes the following types of substances:

Flammable Solids	Self-reactive substances	Solid desensitized explosives	Polymerizing substances
See 4.2.2	See 4.2.3	See 4.2.4	See 4.2.5

4.2.2 Division 4.1 – Flammable solids

4.2.2.1 *Definitions and properties*

4.2.2.1.1 Flammable solids are readily combustible solids and solids which may cause fire through friction.

4.2.2.1.2 Readily combustible solids are powdered, granular or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly. The danger may not only come from the fire but also from toxic combustion products. Metal powders are especially dangerous because of the difficulty of extinguishing a fire since normal extinguishing agents such as carbon dioxide or water can increase the hazard.

4.2.2.1.3 Metal powders are powders of metals or metal alloys.

4.2.2.2 *Classification of flammable solids*

4.2.2.2.1 Powdered, granular or pasty substances must be classified as readily combustible solids of Division 4.1 when the time of burning of one or more of the test runs, performed in accordance with the test methods and criteria in the UN *Manual of Tests and Criteria,* Part III, subsection 33.2.1, is less than 45 seconds or the rate of burning is more than 2.2 mm/s. Metal powders must be classified in Division 4.1 when they can be ignited and the reaction spreads over the whole length of the sample in 10 minutes or less.

4.2.2.2.2 Solids which may cause fire through friction must be classified in Division 4.1 by analogy with existing entries (such as matches) until definitive criteria are established.

4.2.2.3 *Assignment of packing groups*

4.2.2.3.1 Packing groups are assigned on the basis of the test methods referred to in 4.2.2.2.1. For readily combustible solids (other than metal powders), Packing Group II must be assigned if the burning time is less than 45 seconds and the flame passes the wetted zone. Packing Group II must be assigned to metal powders if the zone of reaction spreads over the whole length of the sample in 5 minutes or less.

4.2.2.3.2 Packing groups are assigned on the basis of the test methods referred to in 4.2.2.2.1. For readily combustible solids (other than metal powders), Packing Group III must be assigned if the burning time is less than 45 seconds and the wetted zone stops the flame propagation for at least 4 minutes. Packing Group III must be assigned to metal powders if the reaction spreads over the whole length of the sample in more than 5 minutes but not more than 10 minutes.

4.2.2.3.3 Solids which may cause fire through friction must be assigned to a packing group by analogy with existing entries or in accordance with any appropriate special provision (see Table 3-2).

4.2.3 Division 4.1 – Self-reactive substances

4.2.3.1 *Definitions and properties*

4.2.3.1.1 Definitions

For the purposes of these Instructions:

Self-reactive substances are thermally unstable substances liable to undergo a strongly exothermic decomposition even without the Segmenticipation of oxygen (air). The following substances must not be considered to be self-reactive substances of Division 4.1 if:

a) they are explosive according to the criteria of Class 1;

b) they are oxidizing substances according to the classification procedure for Division 5.1 (see 5.2.1.1) except that mixtures of oxidizing substances which contain 5.0 per cent or more of combustible organic substances must be subjected to the classification procedure defined in Note 3;

c) their self-accelerating decomposition temperature is greater than 75°C for a 50 kg package.

d) they are organic peroxides according to the criteria of Division 5.2;

e) their heat of decomposition is less than 300 J/g; or

Note 1. — The heat of decomposition can be determined by using any internationally recognized method, such as differential scanning calorimetry and adiabatic calorimetry.

Note 2. — Any substance which shows the properties of a self-reactive substance must be classified as such, even if this substance gives a positive test result, according to 4.3.2 for inclusion in Division 4.2.

Note 3. — Mixtures of oxidizing substances meeting the criteria of Division 5.1 which contain 5.0 per cent or more of combustible organic substances, which do not meet the criteria mentioned in a), c), d) or e) above, must be subjected to the self-reactive substance classification procedure.

A mixture showing the properties of a self-reactive substance, type G, according to the principle of 2.4.2.3.3.2 (g) of the UN Recommendations must be considered for classification as a substance of Division 5.1 (see 5.2.1.1).

A mixture showing the properties of a self-reactive substance, type B to F, must be classified as a self-reactive substance of Division 4.1.

4.2.3.1.2 Properties

The decomposition of self-reactive substances can be initiated by heat, contact with catalytic impurities (such as acids, heavy-metal compounds, bases), friction or impact. The rate of decomposition increases with temperature and varies with the substance.

Decomposition, particularly if no ignition occurs, may result in the evolution of toxic gases or vapours. For certain self-reactive substances, the temperature must be controlled. Some self-reactive substances may decompose explosively, Segmenticularly if confined; this characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Some self-reactive substances burn vigorously. Self-reactive substances include some of the following types of compounds:

A	Aliphatic azo compounds	(—C—N=N—C—);
B	Organic azides	(—C—N3);
C	Diazonium salts	(—CN +Z−);
D	N-nitroso compounds	(—N—N=O);
E	aromatic sulphohydrazides	(—SO2—NH—NH2)

This list is not exhaustive and substances with other reactive groups and some mixtures of substances may have similar properties.

4.2.3.2 *Classification of self-reactive substances*

4.2.3.2.1 Self-reactive substances are classified into seven types according to the degree of danger they present. The types of self-reactive substance range from type A, which is forbidden in any mode of transport, to type G, which is not subject to the provisions for self-reactive substances of Division 4.1. The classification of types B to F is directly related to the maximum quantity allowed in one packaging.

4.2.3.2.2 Related substances are specifically listed by name in the Dangerous Goods List (Table 3-1). Related substances are UN 2956, UN 3242 and UN 3251.

4.2.3.2.3 Self-reactive substances permitted for transport are listed in 4.2.3.2.4. For each permitted substance listed, the appropriate generic entry of the Dangerous Goods List (UN 3221 to 3240) is assigned, and appropriate subsidiary hazard(s) and remarks providing relevant information are given. The generic entries specify:

— the self-reactive substance type (B to F);

— the physical state (that is, liquid/solid); and

— when temperature control is required.

4.2.3.2.4 List of currently assigned self-reactive substances in packagings

The following table (Table 2-6) is reproduced from the UN Model Regulations, with irrelevant material removed.

Table 2-6. List of currently assigned self-reactive substances in packagings

Note. — Self-reactive substances to be transported must fulfil the classification and the control and emergency temperatures (derived from the self-accelerating decomposition temperature (SADT)) as listed.

Self-reactive substance	*Control temperature (°C)*	*Emergency temperature (°C)*	*UN generic entry*		*Concentration (%)*	*Note*
Acetone-pyrogallol copolymer 2-diazo-1-naphthol-5-sulphonate			3228		100	
Azodicarbonamide formulation type B, temperature controlled			FORBIDDEN		<100	1.2
Azodicarbonamide formulation type C			3224		<100	3
Azodicarbonamide formulation type C, temperature controlled			3234		<100	3
Azodicarbonamide formulation type D			3226		<100	4
Azodicarbonamide formulation type D, temperature controlled			3236		<100	4
2,2'-Azodi (2,4-dimethyl-4-methoxyvaleronitrile)	–5	+5	3236		100	
2,2'-Azodi (2,4-dimethyl-valeronitrile)	+10	+15	3236		100	
2,2'-Azodi (ethyl-2-methylpropionate)	+20	+25	3235		100	
1,1'-Azodi (hexahydrobenzonitrile)			3226		100	
2,2'-Azodi (isobutyronitrile)	+40	+45	3234		100	
2,2'-Azodi (isobutyronitrile) as a water-based paste			3224		≤50	
2,2'-Azodi (2-methylbutyronitrile)	+35	+40	3236		100	
Benzene-1,3-disulphonyl hydrazide, as a paste			3226		52	
Benzenesulphonyl hydrazide			3226		100	
4-(Benzyl(ethyl)amino)-3-ethoxybenzenediazonium zinc chloride			3226		100	
4-(Benzyl(methyl)amino)-3-ethoxybenzenediazonium zinc chloride	+40	+45	3236		100	
3-Chloro-4-diethylaminobenzenediazonium zinc chloride			3226		100	
2-Diazo-1-naphthol-4-sulphonyl chloride			FORBIDDEN	2	100	2
2-Diazo-1-naphthol-5-sulphonyl chloride			FORBIDDEN	2	100	2
2-Diazo-1-naphthol sulphonic acid ester mixture, type D			3226	7	<100	7
2,5-Dibutoxy-4-(4-morpholinyl)-benzenediazonium, tetrachlorozincate (2:1)			3228		100	
2,5-Diethoxy-4-morpholinobenzenediazonium tetrafluoroborate	+30	+35	3236		100	
2,5-Diethoxy-4-morpholinobenzenediazonium zinc chloride	+35	+40	3236		67-100	
2,5-Diethoxy-4-morpholinobenzenediazonium zinc chloride	+40	+45	3236		66	
2,5-Diethoxy-4-(4-morpholinyl)-benzenediazonium sulphate			3226		100	

Self-reactive substance		*Control temperature (°C)*	*Emergency temperature (°C)*	*UN Generic entry*		*Concentration (%)*	*Note*
2,5-Diethoxy-4-(phenylsulphonyl) benzenediazonium zinc chloride		+40	+45	3236		67	
Diethyleneglycol bis (allyl carbonate) + Di-isopropyl-peroxydicarbonate		–10	0	3237		≥88 + ≤12	
2,5-Dimethoxy-4-(4-methylphenylsulphonyl) benzenediazonium zinc chloride		+40	+45	3236		79	
4-(Dimethylamino)-benzenediazonium trichlorozincate (-1)				3228		100	
4-Dimethylamino-6-(2-dimethylaminoethoxy) toluene-2-diazonium zinc chloride		+40	+45	3236		100	
N,N'-Dinitroso-N,N'-dimethyl terephthalamide, as a paste				3224		72	
N,N'-Dinitrosopentamethylenetetramine				3224		82	5
Diphenyloxide-4,4'-disulphonyl hydrazide				3226		100	
4-Dipropylaminobenzenediazonium zinc chloride				3226		100	
2-(N,N-Ethoxycarbonylphenylamino)-3-methoxy-4-(N-methyl-N-cyclohexylamino) benzenediazonium zinc chloride		+40	+45	3236		63-92	
2-(N,N-Ethoxycarbonylphenylamino)-3-methoxy-4-(N-methyl-N-cyclohexylamino) benzenediazonium zinc chloride		+35	+40	3236		62	
N-Formyl-2-(nitromethylene)-1,3-perhydrothiazine		+45	+50	3236		100	
2-(2-Hydroxyethoxy)-1-(pyrrolidin-1-yl) benzene-4-diazonium zinc chloride		+45	+50	3236		100	
3-(2-Hydroxyethoxy)-4-(pyrrolidin-1-yl) benzenediazonium zinc chloride		+40	+45	3236		100	
(7-Methoxy-5-methyl-benzothiophen-2-yl) boronic acid				3230		88-100	9
2-(N,N-Methylaminoethylcarbonyl)-4-(3,4-dimethylphenylsulphonyl) benzenediazonium hydrogen sulphate		+45	+50	3236		96	
4-Methylbenzenesulphonylhydrazide				3226		100	
3-Methyl-4-(pyrrolidin-1-yl) benzenediazonium tetrafluoroborate		+45	+50	3234		95	
4-Nitrosophenol		+35	+40	3236		100	
Phosphorothioic acid, O-[(cyanophenyl methylene) azanyl] O,O-diethylester				3227		82-91 (Z isomer)	8
Self-reactive liquid, sample				3223			6
Self-reactive liquid, sample temperature controlled				3233			
Self-reactive solid, sample				3224			
Self-reactive solid, sample temperature controlled				3234		100 100 100	
Sodium 2-diazo-1-naphthol-4-sulphonate				3226 3226 3234			
Sodium 2-diazo-1-naphthol-5-sulphonate							
Tetramine palladium (II) nitrate		+30	+35				

		NOTES: 1. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (b) of the UN Model Regulations. 2. "EXPLOSIVE" subsidiary hazard label required and consequently forbidden for transport by air under any circumstance. 3. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (c) of the UN Model Regulations. 4. Azodicarbonamide formulations which fulfil the criteria of 2.4.2.3.3.2 (d) of the UN Model Regulations. 5. With a compatible diluent having a boiling point of not less than 150°C. 6. See 4.2.3.2.6. 7. This entry applies to mixtures of esters of 2-diazo-1-naphthol-4-sulphonic acid and 2-diazo-1-naphthol-5-sulphonic acid meeting the criteria of 2.4.2.3.3.2 d) of the UN Model Regulations. 8. This entry applies to the technical mixture in n-butanol within the specified concentration limits of the (Z) isomer. 9. The technical compound with the specified concentration limits may contain up to 12% water and up to 1% organic impurities.

4.2.3.2.5 Classification of self-reactive substances not listed in Table 2-6 and assignment to a generic entry must be made by the appropriate authority of the State in which the dangerous goods were manufactured on the basis of a test report. Principles applying to the classification of such substances are provided in the UN Recommendations. The applicable classification procedures, test methods and criteria, and an example of a suitable test report, are given in the current edition of the UN *Manual of Tests and Criteria*, SEGMENT II. The statement of approval must contain the classification and the relevant transport conditions.

4.2.3.2.6 Samples of self-reactive substances not listed in Table 2-6, for which a complete set of test results is not available, and which are to be transported for further testing or evaluation, may be assigned to one of the appropriate entries for self-reactive substances type C provided the following conditions are met:

a) The available data indicate that the sample would be no more dangerous than self-reactive substances type B;

b) The sample is packed in a combination packaging consisting of a plastic IP.2 inner packaging with a capacity not exceeding 0.5 L or 0.5 kg which is placed in a wooden box (4C1), plywood box (4D) or fibreboard box (4G) with the maximum net quantity per package not exceeding 1 L or 1 kg; and

c) the available data indicate that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation.

4.2.3.3 *Temperature control requirements*

With the exception of self-reactive solids of type B, which are forbidden for transport by air under any circumstance, self-reactive substances which require temperature control during transport are forbidden for transport by air unless exempted. Self-reactive substances must be subject to temperature control if their self-accelerating decomposition temperature (SADT) is less than or equal to 55°C. Test methods for determining the SADT are given in the current edition of the UN *Manual of Tests and Criteria*. The test selected must be conducted in a manner which is representative of the package to be transported both in size and material of construction.

4.2.3.4 *Desensitization of self-reactive substances*

4.2.3.4.1 In order to ensure safety in transport, self-reactive substances may be desensitized by the use of a diluent. When a diluent is used, the self-reactive substance must be tested with the present diluent in the concentration and form to be used in transport.

4.2.3.4.2 Diluents, which may allow a self-reactive substance to concentrate to a dangerous extent in the event of leakage from a package, must not be used.

4.2.3.4.3 The diluent used must be compatible with the self-reactive substance. In this

regard, compatible diluents are those solids or liquids which have no detrimental influence on the thermal stability and hazard type of the self-reactive substance.

4.2.4 Division 4.1 – Solid desensitized explosives

4.2.4.1 *Definition*

Solid desensitized explosives are explosive substances which are wetted with water or alcohols or are diluted with other substances to form a homogeneous solid mixture to suppress their explosive properties. Entries in the Dangerous Goods List for solid desensitized explosives are UN 1310, 1320, 1321, 1322, 1336, 1337, 1344, 1347, 1348, 1349, 1354, 1355, 1356, 1357, 1517, 1571, 2555, 2556, 2557, 2852, 2907, 3317, 3319, 3344, 3364, 3365, 3366, 3367, 3368, 3369, 3370, 3376, UN 3380 and UN 3474.

4.2.4.2 Substances that:

a) have been provisionally accepted into Class 1 according to Test Series 1 and 2 but exempted from Test Series 6;

b) are not self-reactive substances of Division 4.1;

c) are not substances of Class 5;

are also assigned to Division 4.1. UN 2956, UN 3241, UN 3242 and UN 3251 are such entries.

4.2.5 Division 4.1 – Polymerizing substances and mixtures (stabilized)

4.2.5.1 *Definitions and properties*

4.2.5.1.1 Polymerizing substances are substances which, without stabilization, are liable to undergo a strong exothermic reaction resulting in the formation of larger molecules or resulting in the formation of polymers under conditions normally encountered in transport. Such substances are considered to be polymerizing substances of Division 4.1 when:

a) their self-accelerating polymerization temperature (SAPT) is 75°C or less under the conditions (with or without chemical stabilization as offered for transport) and in the packaging in which the substance or mixture is to be transported;
b) they do not meet any other criteria for inclusion in Classes 1 to 8.
c) they exhibit a heat of reaction of more than 300 J/g; and
d) they do not meet any other criteria for inclusion in Classes 1 to 8.

4.2.5.1.2 A mixture meeting the criteria of a polymerizing substance must be classified as a polymerizing substance of Division 4.1.

4.2.5.1.3 Polymerizing substances are subject to temperature control in transport if their self-accelerating polymerization temperature (SAPT) is 50 °C or less in the packaging in which the substance is to be transported.

Note. — Substances meeting the criteria of a polymerizing substance and also for inclusion in Classes 1 to 8 are subject to the requirements of Special Provision A209.

4.3 SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION (DIVISION 4.2)

4.3.1 Definitions and properties

4.3.1.1 Division 4.2 includes:

a) pyrophoric substances: substances, including mixtures and solutions (liquid or solid), which even in small quantities ignite within 5 minutes of coming into contact with air. These substances are the most liable to spontaneous combustion and are called pyrophoric substances; and
b) self-heating substances: other substances which in contact with air without energy supply are liable to self-heating. These substances will ignite only when in large amounts (kilograms) and after long periods of time (hours or days) and are called self-heating substances.

4.3.1.2 Self-heating of a substance is a process where the gradual reaction of that substance with oxygen (in the air) generates heat. If the rate of heat production exceeds the rate of heat loss, then the temperature of the substance will rise which, after an induction time, may lead to self-ignition and combustion.

4.3.2 Classification in Division 4.2

4.3.2.1 Solids are considered pyrophoric solids which must be classified in Division 4.2 if, in tests performed in accordance with the test method given in the current edition of the UN *Manual of Tests and Criteria*, Part III, subsection 33.3.1.4, the sample ignites in one of the tests.

4.3.2.2 Liquids are considered pyrophoric liquids which must be classified in Division 4.2 if, in tests performed in accordance with the test method given in the current edition of the UN *Manual of Tests and Criteria*, Part III, subsection 33.3.1.5, the liquid ignites in the first SEGMENT of the test, or if it ignites or chars the filter paper.

4.3.2.3 *Self-heating substances*

4.3.2.3.1 A substance must be classified as a self-heating substance of Division 4.2 if, in tests performed in accordance with the test method given in the current edition of the UN *Manual of Tests and Criteria*, Part III, subsection 33.3.1.6:

a) A positive result is obtained using a 25 mm sample cube at 140°C;

b) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 100 mm sample cube at 120°C and the substance is to be transported in packages with a volume of more than 3 m^3;

c) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 100 mm sample cube at 100°C and the substance is to be transported in packages with a volume of more than 450 L;

d) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a positive result is obtained using a 100 mm sample cube at 100°C.

Self-reactive substances which also give a positive result according to this test method must not be classified in Division 4.2 but in Division 4.1.

4.3.2.3.2 A substance must not be classified in Division 4.2 if:

a) a negative result is obtained in a test using a 100 mm sample cube at 140°C;

b) a positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm sample cube at 140°C, a negative result is obtained in a test using a 100 mm sample cube at 100°C and the substance is to be transported in packages with a volume of not more than 450 L.

c) a positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm sample cube at 140°C, a negative result is obtained in a test using a 100 mm sample cube at 120°C and the substance is to be transported in packages with a volume of not more than 3 cubic metres; or

4.3.3 Assignment of packing groups

4.3.3.1 Packing Group I must be assigned to all pyrophoric liquids and solids.

4.3.3.2 Packing Group II must be assigned to self-heating substances which give

positive results in a test using a 25 mm sample cube at 140°C.

4.3.3.3 Packing Group III must be assigned to self-heating substances if:

a) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm sample cube at 140°C and the substance is to be transported in packages with a volume of more than 3 cubic metres;

b) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm sample cube at 140°C, a positive result is obtained in a test using a 100 mm sample cube at 120°C and the substance is to be transported in packages with a volume of more than 450 L; or

c) A positive result is obtained in a test using a 100 mm sample cube at 140°C and a negative result is obtained in a test using a 25 mm sample cube at 140°C and a positive result is obtained in a test using a 100 mm sample cube at 100°C.

4.4 SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES (DIVISION 4.3)

4.4.1 Definitions and properties

Certain substances in contact with water emit flammable gases which can form explosive mixtures with air. Such mixtures are easily ignited by all ordinary sources of ignition, for example:

- naked lights
- sparking hand tools
- unprotected lamps

The resulting blast wave and flames may endanger people and the environment. The test method referred to in 4.4.2 must be used to determine whether the reaction of a substance with water leads to the development of a dangerous amount of gases which may be flammable. It must not be applied to pyrophoric substances.

4.4.2 Classification in Division 4.3

Substances which, in contact with water, emit flammable gases must be classified in Division 4.3 if, in tests performed in accordance with the test method given in the UN *Manual of Tests and Criteria*, Part III, subsection 33.4.1:

a) spontaneous ignition takes place in any step of the test procedure; or

b) there is an evolution of a flammable gas at a rate greater than 1 L/kg of the substance per hour.

4.4.3 Assignment of packing groups

4.4.3.1 Packing Group I must be assigned to any substance which reacts vigorously with

water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 L/kg of substance over any one minute.

4.4.3.2 Packing Group II must be assigned to any substance which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 L/kg of substance per hour, and which does not meet the criteria for Packing Group I.

4.4.3.3 Packing Group III must be assigned to any substance which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is greater than 1 L/kg of substance per hour, and which does not meet the criteria for Packing Groups I or II.

4.5 CLASSIFICATION OF ORGANOMETALLIC SUBSTANCES

Depending on their properties, organometallic substances may be classified in Divisions 4.2 or 4.3, as appropriate, in accordance with the flowchart scheme given in Figure 2.4.2 of the UN *Recommendations on the Transport of Dangerous Goods.*

Section 5

CLASS 5 – OXIDIZING SUBSTANCES; ORGANIC PEROXIDES

INTRODUCTORY NOTE

Because of the different properties exhibited by dangerous goods within Divisions 5.1 and 5.2, it is impracticable to establish a single criterion for classification in either division. Tests and criteria for assignment to the two divisions of Class 5 are addressed in this Section and in the UN *Manual of Tests and Criteria*.

5.1 DEFINITIONS AND GENERAL PROVISIONS

Class 5 is divided into two divisions as follows:

a) Division 5.1 – Oxidizing substances

Substances which, in themselves are not necessarily combustible, may generally, by yielding oxygen, cause or contribute to the combustion of other material. Such substances may be contained in an article.

b) Division 5.2 – Organic peroxides

Organic substances which contain the bivalent —O—O— structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable substances, which may undergo exothermic, self-accelerating decomposition. In addition, they may have one or more of the following properties:

i) be liable to explosive decomposition;

ii) burn rapidly

iii) cause damage to the eyes.

iv) be sensitive to impact or friction;

v) react dangerously with other substances;

5.2 OXIDIZING SUBSTANCES (DIVISION 5.1)

5.2.1 Classification in Division 5.1

5.2.1.1 Oxidizing substances are classified in Division 5.1 in accordance with the

test methods, procedures and criteria in Segment 5 and the UN *Manual of Tests and Criteria,* Part III, section 34. In the event of divergence between test results and known experience, the appropriate authority of the State in which the dangerous goods were manufactured must be consulted to establish the appropriate classification and packing group.

Note. — Where substances of this division are listed in the Dangerous Goods List in 3;2, reclassification of those substances in accordance with these criteria need only be undertaken when this is necessary for safety.

5.2.1.2 By exception, solid ammonium nitrate-based fertilizers must be classified in accordance with the procedure as set out in the UN *Manual of Tests and Criteria*, Part III, section 39.

5.2.1.3 For substances having other hazards, such as toxicity or corrosivity, the requirements of Segment 2, Introductory Section must be met.

5.2.2 Oxidizing solids

5.2.2.1 *Criteria for classification in Division 5.1*

5.2.2.1.1 Tests are performed to measure the potential for a solid substance to increase the burning rate or burning intensity of a combustible substance when the two are thoroughly mixed. The procedure is given in the UN *Manual of Tests and Criteria*, Part III, subsection 34.4.1 (test O.1) or alternatively, in subsection 34.4.3 (test O.3). Tests are conducted on the substance to be evaluated mixed with dry fibrous cellulose in mixing ratios of 1:1 and 4:1, by mass, of sample to cellulose. The burning characteristics of the mixtures are compared:

a) in the test O.1, with the standard 3:7 mixture, by mass, of potassium bromate to cellulose. If the burning time is equal to or less than this standard mixture, the burning times should be compared with those from the Packing Group I or II reference standards, 3:2 and 2:3 ratios, by mass, of potassium bromate to cellulose, respectively; or

b) in the test O.3, with the standard 1:2 mixture, by mass, of calcium peroxide to cellulose. If the burning rate is equal to or greater than this standard mixture, the burning rates must be compared with those from the Packing Group I or II reference standards 3:1 and 1:1 ratios, by mass, of calcium peroxide to cellulose, respectively.

5.2.2.1.2 The classification test results are assessed on the basis of:

a) the comparison of the mean burning time (for the test O.1) or burning rate (for the test O.3) with those of the reference mixtures; and

b) whether the mixture of substance and cellulose ignites and burns.

5.2.2.1.3 A solid substance is classified in Division 5.1 if the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits:

a) in the test O.1, a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose; or

b) in the test O.3, a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose.

5.2.2.2 Assignment of packing groups

Solid oxidizing substances are assigned to a packing group according to one of the test procedures in the UN *Manual of Tests and Criteria*, Part III, section 34.4.1 (Test O.1) or alternatively, in subsection 34.4.3 (Test O.3), in accordance with the following criteria:

a) Test O.1:

   i) Packing Group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose;

   ii) Not Division 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits mean burning times greater than that of a 3:7 mixture (by mass) of potassium bromate and cellulose.

   iii) Packing Group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for Packing Group I are not met;

   iv) Packing Group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for Packing Groups I and II are not met;

b) Test O.3:

   i) **Packing Group I:** any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate greater than the mean burning rate of a 3:1 mixture (by mass) of calcium peroxide and cellulose;

   ii) **Packing Group II**: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:1 mixture (by mass) of calcium peroxide and cellulose, and the criteria for Packing Group I are not met;

   iii) **Packing Group III**: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose, and the criteria for Packing Groups I and II are not met;

   iv) **Not Division 5.1:** any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits a mean burning rate less than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose.

5.2.3 Oxidizing liquids

5.2.3.1 *Criteria for classification in Division 5.1*

5.2.3.1.1 A test is performed to determine the potential for a liquid substance to increase the burning rate or burning intensity of a combustible substance or for spontaneous ignition to occur when the two are thoroughly mixed. The procedure is given in the UN *Manual of Tests and Criteria*, Part III, subsection 34.4.2 (Test O.2). It measures the pressure rise time during combustion. Whether a liquid is an oxidizing substance of Division 5.1 and, if so, whether Packing Group I, II or III must be assigned, is decided on the basis of the test result (see also precedence of hazards characteristics).

5.2.3.1.2 The classification test results are assessed on the basis of:

a) whether the mixture of substance and cellulose spontaneously ignites;

b) the comparison of the mean time taken for the pressure to rise from 690 kPa to 2 070 kPa gauge with those of the reference substances.

5.2.3.1.3 A liquid substance is classified in Division 5.1 if the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65 per cent aqueous nitric acid and cellulose.

5.2.3.2 *Assignment of packing groups*

Liquid oxidizing substances are assigned to a packing group according to the test procedure in the UN *Manual of Tests and Criteria*, Part III, section 34.4.2, in accordance with the following criteria:

Packing Group I: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested,

- spontaneously ignites;
- or the mean pressure rise time of a 1:1 mixture, by mass, of substance and cellulose is less than that of a 1:1 mixture, by mass, of 50 per cent perchloric acid and cellulose.

Packing Group II: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40 per cent aqueous sodium chlorate solution and cellulose; and the criteria for Packing Group I are not met.

Packing Group III: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65 per cent aqueous nitric acid and cellulose; and the criteria for Packing Groups I and II are not met.

Not Division 5.1: any substance which, in the 1:1 mixture, by mass, of substance and cellulose tested, exhibits a pressure rise of less than 2 070 kPa gauge; or exhibits a mean pressure rise time greater than the mean pressure rise time of a 1:1 mixture, by mass, of 65 per cent aqueous nitric acid and cellulose.

5.3 ORGANIC PEROXIDES (DIVISION 5.2)

5.3.1 Properties

5.3.1.1 Organic peroxides are liable to exothermic decomposition which can be started by heat, contact with impurities (such as acids, heavy metal compounds, amines), friction or impact. The rate of decomposition increases with temperature and varies with the peroxide formulation. Decomposition may result in the evolution of harmful or flammable gases or vapours. For certain organic peroxides the temperature must be controlled during transport. Some organic peroxides decompose explosively, particularly if confined. This characteristic may be modified by the addition of diluents or by the use of appropriate packagings. Many organic peroxides burn vigorously.

5.3.1.2 Contact of organic peroxides with the eyes should be avoided. Some organic peroxides will cause serious injury to the cornea, even after brief contact, or will be corrosive to the skin.

5.3.2 Classification of organic peroxides

5.3.2.1 Any organic peroxide must be considered for classification in Division 5.2 unless the organic peroxide formulation contains:

a) not more than 1.0 per cent available oxygen from the organic peroxides when containing not more than 1.0 per cent hydrogen peroxide; or

b) not more than 0.5 per cent available oxygen from the organic peroxides when containing more than 1.0 per cent but not more than 7.0 per cent hydrogen peroxide.

Note.— The available oxygen content (per cent) of an organic peroxide formulation is given by the formula

$$16 \times \Sigma \, (n_i \times c_i / m_i)$$

where n_i *= number of peroxygen groups per molecule of organic peroxide i;* c_i *= concentration (mass in percentage) of organic peroxide i; and* m_i *= molecular mass of organic peroxide i.*

5.3.2.2 Organic peroxides are classified into seven types according to the degree of danger they present. The types of organic peroxide range from type A, which is forbidden in any mode of transport, to type G, which is not subject to the provisions for organic peroxides of Division 5.2. The classification of types B to F is directly related to the maximum quantity allowed in one packaging.

5.3.2.3 Organic peroxides permitted for transport are listed in Segment 5. For each permitted substance, Table 2-7 assigns the appropriate generic entry in the Dangerous Goods List (UN 3103 to 3120) and provides relevant information. The generic entries specify:

a) organic peroxide type (B to F);

b) physical state (liquid or solid); and

c) temperature control, when required.

5.3.2.3.1 Mixtures of the listed formulations may be classified as the same type of organic peroxide as that of the most dangerous component and be transported under the conditions of transport given for this type. However, as two stable components can form a thermally less stable mixture, the self-accelerating decomposition temperature (SADT) of the mixture must be determined and, if necessary, temperature control applied as required by Segment 5.

5.3.2.4 *List of currently assigned organic peroxides in packagings*

Table 2-7 provides a list of currently assigned organic peroxides in packagings. Classification of organic peroxides not listed in Table 2-7 and assignment to a generic entry must be made by the appropriate authority of the State in which the dangerous goods were manufactured on the basis of a test report. Principles applying to the classification of such substances are provided in 2.5.3.3 of the UN Recommendations. The applicable classification procedures, test methods and criteria, and an example of a suitable test report, are given in the current edition of the UN *Manual of Tests and Criteria*, Part II. The statement of approval must contain the classification and the relevant transport conditions.

5.3.2.5 Samples of new formulations of organic peroxides not listed in Table 2-7 for which complete test data are not available and which are to be transported for further testing or evaluation may be assigned to one of the appropriate entries for **Organic peroxide Type C** provided that the following conditions are met:

a) the available data indicate that the sample would be no more dangerous than organic peroxide type B;

b) it is packed in a combination packaging consisting of a plastic IP.2 inner packaging with a capacity not exceeding 0.5 L or 0.5 kg which is placed in a wooden box (4C1), plywood box (4D) or fibreboard box (4G) with the maximum net quantity per package not exceeding 1 L or 1 kg; and

c) the available data indicate that the control temperature, if any, is sufficiently low to prevent any dangerous decomposition and sufficiently high to prevent any dangerous phase separation.

5.3.3 Temperature control requirements

5.3.3.1 An organic peroxide formulation must be regarded as possessing explosive properties when, in laboratory testing, the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement. With the exception of organic peroxides of type B, which are forbidden for transport by air under any circumstance, organic peroxides requiring temperature control during transport are forbidden for transport by air unless approved or exempted, as applicable.

5.2.1.1 The following organic peroxides must be subjected to temperature control during carriage:

Organic peroxides types B and C	with an SADT ≤50°C;
Organic peroxides type D	showing a medium effect when heated under confinement with an SADT ≤50°C or showing a low or no effect when heated under confinement with an SADT ≤45°C; and
Organic peroxides types E and F	with an SADT ≤45°C.

5.3.3.2 Test methods for determining the SADT are given in the UN *Manual of Tests and Criteria*, Part III, section 28. The test selected must be conducted in a manner which is representative of the package to be transported.

5.3.3.3 Test methods for determining the flammability are given in the UN *Manual of Tests and Criteria*, Part III, subsection 32.4.

5.3.4 Desensitization of organic peroxides

5.3.4.1 In order to ensure safety during transport, organic peroxides are, in many cases, desensitized by organic liquids or solids, inorganic solids or water. Where a percentage of a substance is stipulated, this refers to the percentage by mass, rounded to the nearest whole number. In general, desensitization should be such that in case of spillage or fire, the organic peroxide may not concentrate to a dangerous extent.

5.3.4.2 Unless otherwise stated for the individual organic peroxide formulation, the following definitions apply for diluents used for desensitization:

Diluents type A	are organic liquids which are compatible with the organic peroxide and which have a boiling point of not less than 150°C. Type A diluents may be used for desensitizing all

	organic peroxides;
Diluents type B	are organic liquids which are compatible with the organic peroxide and which have a boiling point of less than 150°C but not less than 60°C and a flash point of not less than 5°C. Type B diluents may be used for desensitization of all organic peroxides provided that the boiling point of the liquid is at least 60°C higher than the SADT in a 50 kg package.

5.3.4.3 Diluents, other than type A or type B, may be added to organic peroxide formulations as listed in Table 2-7 provided that they are compatible. However, replacement of all or part of a type A or type B diluent by another diluent with differing properties requires that the organic peroxide formulation be reassessed in accordance with the normal acceptance procedure for Division 5.2.

5.3.4.4 Water may only be used for the desensitization of organic peroxides which are shown in Table 2-7 or in the statement of approval according to Segment 5 with the approval of the appropriate authority of the State of Manufacture or when the organic peroxide formulation is specified as being with water or as a stable dispersion in water.

5.3.4.5 Organic and inorganic solids may be used for desensitization of organic peroxides provided that they are compatible.

5.3.4.6 Compatible liquids and solids are those which have no detrimental influence on the thermal stability and hazard type of the organic peroxide formulation.

Table 2-7. List of currently assigned organic peroxides in packagings

Note.— Peroxides to be transported must fulfil the classification and the control and emergency temperatures (derived from the self-accelerating decomposition temperature (SADT)) as listed.

Organic peroxide	*Concentration (per cent)*	*Diluent type A (per cent)*	*Diluent type B (per cent) (Note 1)*	*Inert solid (per cent)*	*Water (per cent)*	*Control tempera-ture (°C)*	*Emergency tempera-ture (°C)*	*Sub-sidiary hazards and notes*	*UN generic entry*	
Acetyl acetone peroxide	≤42	≥48			≥8			2		3105
Acetyl acetone peroxide	≤35	≥57			≥8			32		3107
Acetyl acetone peroxide	≤32 as a paste							20		3106
Acetyl cyclohexanesulphonyl peroxide	≤82				≥12	–10	0	3		FORBIDDEN
Acetyl cyclohexanesulphonyl peroxide	≤32		≥68			–10	0			3115
tert-Amyl hydroperoxide	≤88	≥6			≥6					3107
tert-Amyl peroxyacetate	≤62	≥38								3105
tert-Amyl peroxybenzoate	≤100									3103
tert-Amyl peroxy-2-ethylhexanoate	≤100					+20	+25			3115
tert-Amyl peroxy-2-ethylhexyl carbonate	≤100									3105
tert-Amylperoxy isopropyl carbonate	≤77	≥23								3103
tert-Amyl peroxyneodecanoate	≤77		≥23			0	+10			3115

Organic peroxide	Concentration (per cent)	Diluent type A (per cent)	Diluent type B (per cent) (Note 1)	Inert solid (per cent)	Water (per cent)	Control temperature (°C)	Emergency temperature (°C)		UN generic entry
tert-Amyl peroxyneodecanoate	≤47	≥53				0	+10		3119
tert-Amyl peroxypivalate	≤77		≥23			+10	+15		3113
tert-Amylperoxy-3,5,5-trimethylhexanoate	≤100								3105
tert-Butyl cumyl peroxide	>42-100								3109
tert-Butyl cumyl peroxide	≤52			≥48					3108
n-Butyl-4,4-di-(tert-butylperoxy) valerate	>52-100								3103
n-Butyl-4,4-di-(tert-butylperoxy) valerate	≤52			≥48					3108
tert-Butyl hydroperoxide	>79-90			≥10				13	3103
tert-Butyl hydroperoxide	≤80	≥20						4,13	3105
tert-Butyl hydroperoxide	≤79			>14				13,23	3107
tert-Butyl hydroperoxide	≤72			≥28				13	3109
tert-Butyl hydroperoxide + Di-tert-butylperoxide	<82 + >9			≥7				13	3103
tert-Butyl monoperoxymaleate	>52-100							3	FORBIDDEN
tert-Butyl monoperoxymaleate	≤52	≥48							3103
tert-Butyl monoperoxymaleate	≤52		≥48						3108
tert-Butyl monoperoxymaleate	≤52 as a paste								3108
tert-Butyl peroxyacetate	>52-77	≥23						3	FORBIDDEN
tert-Butyl peroxyacetate	>32-52	≥48							3103
tert-Butyl peroxyacetate	≤32		≥68						3109
tert-Butyl peroxybenzoate	>77-100								3103
tert-Butyl peroxybenzoate	>52-77	≥23							3105
tert-Butyl peroxybenzoate	≤52			≥48					3106
tert-Butyl peroxybenzoate	≤32	≥68							3109
tert-Butyl peroxybutyl fumarate	≤52	≥48							3105
tert-Butyl peroxycrotonate	≤77	≥23							3105
tert-Butyl peroxydiethylacetate	≤100					+20	+25		3113
tert-Butyl peroxy-2-ethylhexanoate	>52-100					+20	+25		3113
tert-Butyl peroxy-2-ethylhexanoate	>32-52		≥48			+30	+35		3117
tert-Butyl peroxy-2-ethylhexanoate	≤52			≥48		+20	+25		3118
tert-Butyl peroxy-2-ethylhexanoate	≤32		≥68			+40	+45		3119
tert-Butyl peroxy-2-ethylhexanoate + 2,2-Di-(tert-butylperoxy) butane	≤12 + ≤14	≥14		≥60					3106
tert-Butyl peroxy-2-ethylhexanoate + 2,2-Di-(tert-butylperoxy) butane	≤31 + ≤36	≥14	≥33			+35	+40		3115
tert-Butyl peroxy-2-ethylhexylcarbonate	≤100								3105
tert-Butyl peroxyisobutyrate	>52-77		≥23			+15	+20		FORBIDDEN
tert-Butyl peroxyisobutyrate	≤52		≥48			+15	+20		

tert-Butylperoxy isopropylcarbonate	≤77	≥23							3115
1-(2-tert-Butylperoxy isopropyl)-3-isopropenylbenzene	≤77	≥23							3103
tert-Butylperoxy isopropylcarbonate	≤62		≥38						3105

Organic peroxide	Concentration (per cent)	Diluent type A (per cent)	Diluent type B (per cent) (Note 1)	Inert solid (per cent)	Water (per cent)	Control tempera-ture (°C)	Emergency tempera-ture (°C)	Sub-sidiary hazards and notes	UN generic entry
1-(2-tert-Butylperoxy isopropyl)-3-isopropenylbenzene	≤42			≥58					3108
tert-Butyl peroxy-2-methylbenzoate	≤100								3103
tert-Butyl peroxyneodecanoate	>77-100					–5	+5		3115
tert-Butyl peroxyneodecanoate	≤77		≥23			0	+10		3115
tert-Butyl peroxyneodecanoate	≤52 as a stable dispersion in water					0	+10		3119
tert-Butyl peroxyneodecanoate	≤42 as a stable dispersion in water (frozen)					0	+10		3118
tert-Butyl peroxyneodecanoate	≤32	≥68				0	+10		3119
tert-Butyl peroxyneoheptanoate	≤77	≥23				0	+10		3115
tert-Butyl peroxyneoheptanoate	≤42 as a stable dispersion in water					0	+10		3117
tert-Butyl peroxypivalate	>67-77	≥23				0	+10		3113
tert-Butyl peroxypivalate	>27-67		≥33			0	+10		3115
tert-Butyl peroxypivalate	≤27		≥73			+30	+35		3119
tert-Butylperoxy stearylcarbonate	≤100								3106
tert-Butyl peroxy-3,5,5- trimethylhexanoate	>37-100								3105
tert-Butyl peroxy-3,5,5- trimethylhexanoate	≤42			≥58					3106
tert-Butyl peroxy-3,5,5- trimethylhexanoate	≤37		≥63						3109
3-Chloroperoxybenzoic acid	>57-86			≥14			3		FORBIDDEN
3-Chloroperoxybenzoic acid	≤57			≥3	≥40				3106
3-Chloroperoxybenzoic acid	≤77			≥6	≥17				3106
Cumyl hydroperoxide	>90-98	≤10						13	3107
Cumyl hydroperoxide	≤90	≤10						13,18	3109
Cumyl peroxyneodecanoate	≤77		≥23			–10	0		3115
Cumyl peroxyneodecanoate	≤87	≥13				–10	0		3115
Cumyl peroxyneodecanoate	≤52 as a stable dispersion in water					–10	0		3119
Cumyl peroxyneoheptanoate	≤77	≥23				–10	0		3115
Cumyl peroxypivalate	≤77		≥23			–5	+5	13	3104
Cyclohexanone peroxide(s)	≤91				≥9				
Cyclohexanone peroxide(s)	≤72	≥28							3105
Cyclohexanone peroxide(s)	≤72 as a paste								3106
Cyclohexanone peroxide(s)	≤32			≥68					Exempt

([3r-(3r,5as,6s,8as,9r,10r,12s,12ar**)]-Decahydro-10-methoxy-3,6,9-trimethyl-3,12-epoxy-12h-pyrano[4,3-j]-1,2-benzodioxepin)	≤100									3106
Diacetone alcohol peroxides	≤57		≥26		≥8	+40	+45			3115
Diacetyl peroxide	≤27		≥73			+20	+25			3115

Organic peroxide	*Concentration (per cent)*	*Diluent type A (per cent)*	*Diluent type B (per cent) (Note 1)*	*Inert solid (per cent)*	*Water (per cent)*	*Control tempera-ture (°C)*	*Emergency tempera-ture (°C)*	*Sub-sidiary hazards and notes*	*UN generic entry*
Di-tert-amyl peroxide	≤100								
1,1-Di-(tert-amylperoxy) cyclohexane	≤82	≥18							
Dibenzoyl peroxide	>52-100			≤48					3107
Dibenzoyl peroxide	>77-94				≥6				3103
Dibenzoyl peroxide	≤77				≥23			3	FORB
Dibenzoyl peroxide	≤62			≥28	≥10			3	FORB
Dibenzoyl peroxide	>52-62 as a paste								3104
Dibenzoyl peroxide	>35-52			≥48					3106
Dibenzoyl peroxide	>36-42	≥18			≤40			20	3106
Dibenzoyl peroxide	≤56.5 as a paste				≥15				3106
Dibenzoyl peroxide	≤52 as a paste								3107
Dibenzoyl peroxide	≤42 as a stable dispersion in water								3108
Dibenzoyl peroxide	≤42	≥38			≥13			20	3108
Dibenzoyl peroxide	≤35			≥65					3109
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤100					+30	+35		3109
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤42 as a paste					+35	+40	29	Exempt
Di-(4-tert-butylcyclohexyl) peroxydicarbonate	≤42 as a stable dispersion in water					+30	+35		3114
Di-tert-butyl peroxide	>52-100								3118
Di-tert-butyl peroxide	≤52	≥48							3119
Di-tert-butyl peroxyazelate	≤52	≥48							3107
2,2-Di-(tert-amylperoxy)butane	≤57	≥43						25	3109
2,2-Di-(tert-butylperoxy)butane	≤52	≥48							3105
1,6-Di-(tert-butylperoxycarbonyloxy) hexane	≤72	≥28							3105
1,1-Di-(tert-butylperoxy)cyclohexane	>80-100							3	3103
1,1-Di-(tert-butylperoxy)cyclohexane	>52-80	≥20							3103
1,1-Di-(tert-butylperoxy)cyclohexane	≤72		≥28					3	F
1,1-Di-(tert-butylperoxy)cyclohexane	>42-52	≥48							3103
1,1-Di-(tert-butylperoxy)cyclohexane	≤42	≥13		≥45					3103
1,1-Di-(tert-butylperoxy)cyclohexane	≤42	≥58							3105
1,1-Di-(tert-butylperoxy)cyclohexane	≤27	≥25							3106
1,1-Di-(tert-butylperoxy)cyclohexane	≤13	≥13	≥74						3109
1,1-Di-(tert-butylperoxy)cyclohexane + tert-butyl peroxy-2-ethylhexanoate	≤43+≤16	≥41						21	3107
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	≤90		≥10						3109

	Di-n-butyl peroxydicarbonate	>27-52		≥48			–15	–5			3105
											3103
											3115

Organic peroxide	Concentration (per cent)	Diluent type A (per cent)	Diluent type B (per cent) (Note 1)	Inert solid (per cent)	Water (per cent)	Control tempera-ture (°C)	Emergency tempera-ture (°C)	Subsidiary hazards & notes		UN generic entry
Di-n-butyl peroxydicarbonate	≤42 as a stable dispersion in water (frozen)					–15	–5			3118
Di-n-butyl peroxydicarbonate	≤27		≥73			–10	0			3117
Di-sec-butyl peroxydicarbonate	>52-100					–20	–10			3113
Di-sec-butyl peroxydicarbonate	≤52		≥48			–15	–5			3115
Di-(tert-butylperoxyisopropyl) benzene(s)	>42-100			≤57						3106
Di-(tert-butylperoxyisopropyl) benzene(s)	≤42			≥58					29	Exempt
Di-(tert-butylperoxy)phthalate	>42-52	≥48								3105
Di-(tert-butylperoxy)phthalate	≤52 as a paste								20	3106
Di-(tert-butylperoxy)phthalate	≤42	≥58								3107
2,2-Di-(tert-butylperoxy)propane	≤52	≥48								3105
2,2-Di-(tert-butylperoxy)propane	≤42	≥13		≥45						3106
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	>90-100								3	FORBIDDEN
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	>57-90	≥10								3103
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	≤77		≥23							3103
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	≤57			≥43						3110
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	≤57	≥43								3107
1,1-Di-(tert-butylperoxy)-3,3,5-trimethylcyclohexane	≤32	≥26	≥42							3107
Dicetyl peroxydicarbonate	≤100					+30	+35			3120
Dicetyl peroxydicarbonate	≤42 as a stable dispersion in water					+30	+35			3119
Di-4-chlorobenzoyl peroxide	≤77				≥23				3	forbidden
Di-4-chlorobenzoyl peroxide	≤52 as a paste								20	3106
Di-4-chlorobenzoyl peroxide	≤32			≥68					29	Exempt
Dicumyl peroxide	>52-100								12	3110
Dicumyl peroxide	≤52			≥48					29	Exempt
Dicyclohexyl peroxydicarbonate	>91-100					+10	+15		3	forbidden
Dicyclohexyl peroxydicarbonate	≤91			≥9		+10	+15			3114
Dicyclohexyl peroxydicarbonate	≤42 as a stable dispersion in water					+15	+20			3119
Didecanoyl peroxide	≤100					+30	+35			3114
2,2-Di-(4,4-di(tert-butylperoxy)cyclohexyl) propane	≤42			≥58						

2,2-Di-(4,4-Di-(tert-butylperoxy)cyclohexyl) propane	≤22		≥78					

Organic peroxide	Concentration (per cent)	Diluent type A (per cent)	Diluent type B (per cent) (Note 1)	Inert solid (per cent)	Water (per cent)	Control tempera-ture (°C)	Emergency tempera-ture (°C)	Sub-sidiary hazards and notes	UN generic entry
Di-2,4-dichlorobenzoyl peroxide	≤77				≥23			3	FORBIDDEN
Di-2,4-dichlorobenzoyl peroxide	≤52 as a paste with silicon oil								3104
Di-2,4-dichlorobenzoyl peroxide	≤52 as a paste					+20	+25		3118
Di-(2-ethoxyethyl) peroxydicarbonate	≤52		≥48			–10	0		3115
Di-(2-ethylhexyl)peroxydicarbonate	>77-100					–20	–10		3115
Di-(2-ethylhexyl)peroxydicarbonate	≤77		≥23			–15	–5		3115
Di-(2-ethylhexyl)peroxydicarbonate	≤62 as a stable dispersion in water					–15	–5		3119
Di-(2-ethylhexyl)peroxydicarbonate	≤52 as a stable dispersion in water (frozen)					–15	–5		3120
2,2-Dihydroperoxypropane	≤27			≥73				3	FORBIDDEN
Di-(1-hydroxycyclohexyl)peroxide	≤100								3106
Diisobutyryl peroxide	>32-52		≥48			–20	–10	3	FORBIDDEN
Diisobutyryl peroxide	≤42 as a stable dispersion in water					–20	–10		3119
Diisobutyryl peroxide	≤32		≥68			–20	–10		3115
Diisopropylbenzene dihydroperoxide	≤82	≥5			≥5				3106
Diisopropyl peroxydicarbonate	>52-100					–15	–5	3	FORBIDDEN
Diisopropyl peroxydicarbonate	≤52		≥48			–20	–10		3115
Diisopropyl peroxydicarbonate	≤32	≥68				–15	–5		3115
Dilauroyl peroxide	≤100								3106
Dilauroyl peroxide	≤42 as a stable dispersion in water								3109
Di-(3-methoxybutyl) peroxydicarbonate	≤52		≥48			–5	5		3115
Di-(2-methylbenzoyl) peroxide	≤87				≥13	+30	+35	3	FORBIDDEN
Di-(3-methylbenzoyl) peroxide + Benzoyl (3-methylbenzoyl) peroxide + dibenzoyl peroxide	≤20+≤18+≤4		≥58			35	40		3115
Di-(4-methylbenzoyl) peroxide	≤52 as a paste with silicon oil								3106
2,5-Dimethyl-2,5-di-(benzoylperoxy)hexane	>82-100							3	
2,5-Dimethyl-2,5-di-(benzoylperoxy)hexane	≤82			≥18					3106
2,5-Dimethyl-2,5-di-(benzoylperoxy)hexane	≤82				≥18				3104
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	>90-100								
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	>52-90	≥10							
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	≤77			≥23					3108
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	≤52	≥48							3109

	2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	≤47 as a paste								3108	
+	2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexane	≤22			≥78				29		Exempt

Organic peroxide	*Concentration (per cent)*	*Diluent type A (per cent)*	*Diluent type B (per cent) (Note 1)*	*Inert solid (per cent)*	*Water (per cent)*	*Control tempera-ture (°C)*	*Emergency tempera-ture (°C)*		*Sub-sidiary hazards and notes*	*UN Generic Entry*	
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexyne-3	>86-100								3	FORBIDDEN	
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexyne-3	>52-86	≥14									3103
2,5-Dimethyl-2,5-di-(tert-butylperoxy)hexyne-3	≤52			≥48							3103
2,5-Dimethyl-2,5-di-(2-ethylhexanoylperoxy)hexane	≤100					+20	+25				3106
2,5-Dimethyl-2,5-dihydroperoxyhexane	≤82				≥18						3113
2,5-Dimethyl-2,5-di-(3,5,5-trimethylhexanoylperoxy)hexane	≤77	≥23									3104
1,1-Dimethyl-3-hydroxybutyl peroxyneoheptanoate	≤52	≥48				0	+10				3105
Dimyristyl peroxydicarbonate	≤100					+20	+25				3117
Dimyristyl peroxydicarbonate	≤42 as a stable dispersion in water					+20	+25				3116
Di-(2-neodecanoylperoxyisopropyl) benzene	≤52	≥48				–10	0		3115		3119
Di-n-nonanoyl peroxide	≤100					0	+10				3116
Di-n-octanoyl peroxide	≤100					+10	+15				3114
Di-(2-phenoxyethyl)peroxydicarbonate	>85-100								3	FORBIDDEN	
Di-(2-phenoxyethyl)peroxydicarbonate	≤85				≥15						3106
Dipropionyl peroxide	≤27		≥73			+15	+20				3117
Di-n-propyl peroxydicarbonate	≤100					–25	–15				3113
Di-n-propyl peroxydicarbonate	≤77	≥23				–20	–10				3113
Disuccinic acid peroxide	>72-100								3,17	FORBIDDEN	
Disuccinic acid peroxide	≤72				≥28	+10	+15				3116
Di-(3,5,5-trimethylhexanoyl) peroxide	>52-82	≥18				0	+10				3115
Di-(3,5,5-trimethylhexanoyl) peroxide	≤52 as a stable dispersion in water					+10	+15				3119
Di-(3,5,5-trimethylhexanoyl) peroxide	≤38	≥62				+20	+25				3119
Ethyl 3,3-di-(tert-amylperoxy)butyrate	≤67	≥33									3105
Ethyl 3,3-di-(tert-butylperoxy)butyrate	>77-100										3103
Ethyl 3,3-di-(tert-butylperoxy)butyrate	≤77	≥23									3105
Ethyl 3,3-di-(tert-butylperoxy)butyrate	≤52			≥48							3106
1-(2-Ethylhexanoylperoxy)-1,3-dimethylbutyl peroxypivalate	≤52	≥45	≥10			-20	-10				3115
tert-Hexyl Peroxyneodecanoate	≤71	≥29				0	+10				3115
tert-Hexyl Peroxypivalate	≤72		≥28			+10	+15				3115
tert-Hexyl Peroxypivalate	≤52 as a stable dispersion in water					+15	+20				3117
3-Hydroxy-1,1-dimethylbutyl peroxyneodecanoate	≤77	≥23				–5	+5				3115

3-Hydroxy-1,1-dimethylbutyl peroxyneodecanoate	≤52 as a stable dispersion in water					–5	+5				3119

	Organic peroxide	Concentration (per cent)	Diluent type A (per cent)	Diluent type B (per cent) (Note 1)	Inert solid (per cent)	Water (per cent)	Control tempera-ture (°C)	Emergency tempera-ture (°C)		Sub-sidiary hazards and notes	UN generic entry	
	3-Hydroxy-1,1-dimethylbutyl peroxyneodecanoate	≤52	≥48				–5	+5			3117	
	Isopropyl sec-butyl peroxydicarbonate +di-sec-butyl peroxydicarbonate +di-isopropyl peroxydicarbonate	≤32 + ≤15-18 + ≤12-15	≥38				–20	–10			3115	
	Isopropyl sec-butyl peroxydicarbonate +di-sec-butyl peroxydicarbonate +di-isopropyl peroxydicarbonate	≤52 + ≤28 + ≤22					–20	–10		3		FORBIDDEN
	Isopropylcumyl hydroperoxide	≤72	≥28							13	3109	
	p-Menthyl hydroperoxide	>72-100								13	3105	
	p-Menthyl hydroperoxide	≤72	≥28							27	3109	
	Methylcyclohexanone peroxide(s)	≤67		≥33			+35	+40		3115		
+	Methyl ethyl ketone peroxide(s)	See remark 33	≥41			≥9				33 34	3105	
	Methyl ethyl ketone peroxide(s)	see remark 8)	≥48							3,8,13		FORBIDDEN
	Methyl ethyl ketone peroxide(s)	see remark 9)	≥55							9	3105	
	Methyl ethyl ketone peroxide(s)	see remark 10)	≥60							10	3107	
	Methyl isobutyl ketone peroxide(s)	≤62	≥19							22	3105	
	Methyl isopropyl ketone peroxide(s)	see remark 31)	≥70							31	3109	
	Organic peroxide, liquid, sample											
	Organic peroxide, liquid, sample, temperature controlled										3113	
	Organic peroxide, solid, sample										3104	
	Organic peroxide, solid, sample, temperature controlled										3114	
	3,3,5,7,7-pentamethyl-1,2,4-trioxepane	≤100									3107	
	Peroxyacetic acid, type D, stabilized	≤43									3105	
	Peroxyacetic acid, type E, stabilized	≤43									3107	
	Peroxyacetic acid, type F, stabilized	≤43									3109	
	Peroxylauric acid	≤100					+35	+40			3118	
	1-Phenylethyl hydroperoxide	≤38		≥62							3109	
	Pinanyl hydroperoxide	>56-100									3105	
	Pinanyl hydroperoxide	≤56	≥44								3109	
	Polyether poly-tert-butylperoxycarbonate	≤52		≥23							3107	
	1,1,3,3-Tetramethylbutyl hydroperoxide	≤100									3105	
	1,1,3,3-Tetramethylbutylperoxy-2 ethylhexanoate	≤100					+15	+20			3115	
	1,1,3,3-Tetramethylbutyl peroxyneodecanoate	≤72		≥28			–5	+5			3115	

	1,1,3,3-Tetramethylbutyl peroxyneodecanoate	≤52 as a stable dispersion in water				–5	+5			3199 3115	
	1,1,3,3-Tetramethylbutyl peroxypivalate	≤77	≥23			0	+10			3155	

Organic peroxide	*Concentration (per cent)*	*Diluent type A (per cent)*	*Diluent type B (per cent) (Note 1)*	*Inert solid (per cent)*	*Water (per cent)*	*Control tempera-ture (°C)*	*Emergency tempera-ture (°C)*		*Sub-sidiary hazards and notes*	*UN generic entry*
3,6,9-Triethyl-3,6,9-trimethyl-1,4,7 triperoxonane	≤17	≥18		≥65						3110
3,6,9-Triethyl-3,6,9-trimethyl-1,4,7-triperoxonane	≤42	≥58							28	3105
3,6,9-Triethyl-3,6,9-trimethyl-1,4,7 triperoxonane	≤27	≥83								3109

Notes:

1. Diluent type B may always be replaced by diluent type A. Boiling point diluent type B should be at least 60°C higher than the SADT of the organic peroxide.
2. Available oxygen ≤4.7 per cent.
3. "EXPLOSIVE" subsidiary hazard label required and consequently forbidden for transport by air under any circumstance.
4. Diluent may be replaced by Di-tert-butyl peroxide.
5. Available oxygen ≤9 per cent.
6. With ≤9 per cent hydrogen peroxide; available oxygen ≤10 per cent.
7. Only non-metallic packagings allowed.
8. Available oxygen >10 per cent and ≤10.7 per cent, with or without water.
9. Available oxygen ≤10 per cent, with or without water.
10. Available oxygen ≤8.2 per cent, with or without water.
11. See 5.3.2.5.
12. Not used.
13. "CORROSIVE" subsidiary hazard label required (see Figure 5-24).
14. Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.4.
15. Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.4.
16. Peroxyacetic acid formulations which fulfil the criteria of 5.3.2.4.
17. Addition of water to this organic peroxide will decrease its thermal stability.
18. No "CORROSIVE" subsidiary hazard label required for concentrations below 80 per cent.
19. Mixtures with hydrogen peroxide, water and acid(s).
20. With diluent type A, with or without water.
21. With ≥25 per cent diluent type A by mass, and in addition ethylbenzene.
22. With ≥19 per cent diluent type A by mass, and in addition methyl isobutyl ketone.
23. With <6 per cent di-tert-butyl peroxide.
24. With ≤8 per cent 1-isopropylhydroperoxy-4-isopropylhydroxybenzene.
25. Diluent type B with boiling point >110°C.
26. With <0.5 per cent hydroperoxides content.
27. For concentrations more than 56 per cent, "CORROSIVE" subsidiary hazard label required (see Figure 5-24).
28. Available active oxygen ≤7.6 per cent in diluent type A having a 95 per cent boil-off point in the range of 200-260°C.
29. Not subject to the requirements of these Technical Standardsfor Division 5.2.
30. Diluent type B with boiling point >130°C.
31. Active oxygen ≤6.7 per cent.
32. Active oxygen ≤4.15 per cent.

+ 33. Available oxygen ≤10 per cent.

+ 34. Sum of diluent type A and water ≥55 per cent and in addition methyl ethyl ketone.

Segment Section 6

CLASS 6 – TOXIC AND INFECTIOUS SUBSTANCES

INTRODUCTORY NOTE

Note. — Toxins from plant, animal or bacterial sources which do not contain any infectious substances or toxins that are not contained in substances which are infectious substances should be considered for classification in Division 6.1 and assignment to UN 3172 or UN 3462.

6.1 DEFINITIONS

Class 6 is divided into two divisions as follows:

a) Division 6.1 – Toxic substances.

Substances liable either to cause death or injury or to harm human health if:

- swallowed
- inhaled
- by skin contact.

Note. — In these Technical Standards"poisonous" has the same meaning as "toxic".

b) Division 6.2 – Infectious substances.

Substances known to contain, or reasonably expected to contain, pathogens.

- Pathogens are defined as micro-organisms (including bacteria, viruses, parasites, fungi)
- other agents such as prions, which can cause disease in humans or animals.

6.2 DIVISION 6.1 – TOXIC SUBSTANCES

6.2.1 Definitions

For the purposes of these Instructions:

6.2.1.1 *LD_{50} (median lethal dose) for acute oral toxicity* is the statistically derived single dose of a substance that:

- can be expected to cause death within 14 days in 50 per cent of young adult albino rats when administered by the oral route.
- The LD_{50} value is expressed in terms of mass of test substance per mass of test animal (mg/kg).

6.2.1.2 *LD_{50} for acute dermal toxicity* is that dose of the substance which,

- administered by continuous contact for 24 hours with the bare skin of albino rabbits, is most likely to cause death within 14 days in half of the animals tested.
- The number of animals tested must be sufficient to give a statistically significant result and be in conformity with good pharmacological practices. The result is expressed in mg/kg body mass.

6.2.1.3 *LC_{50} for acute toxicity on inhalation* is that concentration of vapour, mist or dust which,

- administered by continuous inhalation for one hour to both male and female young adult albino rats,
- is most likely to cause death within 14 days in half of the animals tested.
- A solid substance should be tested if at least 10 per cent (by mass) of its total mass is likely to be dust in a respirable range, such as the aerodynamic diameter of that particle-fraction is 10 µm or less.
- A liquid substance should be tested if a mist is likely to be generated in a leakage of the transport containment.
- Both for solid and liquid substances more than 90 per cent (by mass) of a specimen prepared for inhalation toxicity should be in the respirable range as defined above.
- The result is expressed in mg/L of air for dusts and mists or in mL/m^3 of air (parts per million) for vapours.

6.2.2 Assignment of packing groups

6.2.2.1 Substances of Division 6.1, including pesticides, are allocated among the three packing groups, according to the degree of their toxic hazards in transport as follows:

a)	Packing Group I – Preparations and Substances presenting a very severe toxicity hazard;
b)	Packing Group II - Preparations and Substances presenting a serious toxicity hazard;
c)	Packing Group III –Preparations and Substances presenting a relatively low toxicity hazard.

6.2.2.2 In making this grouping, account must be taken of human experience in instances of accidental poisoning, and of special properties possessed by any individual substance, such as liquid state, high volatility, any special likelihood of penetration, and special biological effects.

6.2.2.3 In the absence of human experience, the grouping must be based on the available data from animal experiments. Three possible routes of administrations must be examined. These routes are exposure through:

a) oral ingestion
b) inhalation of dust, mists, or vapours
c) dermal contact; and

6.2.2.3.1 Appropriate animal tests for the various routes of exposure are described in 6.2.1. When a substance exhibits a different order of toxicity by two or more of these routes of administration, the highest degree of danger must be assigned.

6.2.2.4 The criteria to be applied for grouping a substance according to the toxicity it exhibits by all three routes of administration are presented in the following paragraphs.

6.2.2.4.1 The grouping criteria for the oral and dermal routes as well as for inhalation of dusts and mists are as shown in Table 2-8.

Note. — Substances meeting the criteria of Class 8 and with an inhalation toxicity of dusts and mists (LC_{50}) leading to Packing Group I are only accepted for an allocation to Division 6.1 if the toxicity through oral ingestion or dermal contact is at least in the range of Packing Group I or II. Otherwise, an allocation to Class 8 is made when appropriate (see 8.2.4).

6.2.2.4.2 The criteria for inhalation toxicity of dusts and mists in 6.2.2.4.1 are based on LC_{50} data relating to 1-hour exposures, and where such information is available, it must be used. However, where only LC_{50} data relating to 4-hour exposures to dusts and mists are available, such figures can be multiplied by four and the product substituted in the above criteria, that is, LC_{50} (4 h) × 4 is considered the equivalent of LC_{50} (1 h).

6.2.2.4.3 Liquids having toxic vapours must be assigned to the packing groups shown in Table 2-9, where V is that saturated vapour concentration in the air of the substance in mL/m^3 at 20°C and standard atmospheric pressure.

6.2.2.4.4 In Figure 2-1, the criteria according to 6.2.2.4.3 are expressed in graphical form, as an aid to easy classification. However, because of approximations inherent in the use of graphs, substances on or near packing group borderlines must be checked using numerical criteria.

Table 2-8. Grouping criteria for administration through oral ingestion, dermal contact and inhalation of dusts and mists

Packing group	*Oral toxicity LD_{50} (mg/kg)*	*Inhalation toxicity by dusts and mists LC_{50} (mg/L)*	*Dermal toxicity LD50 (mg/kg)*

I	≤5.0	≤0.2	≤50
II	>5.0 and ≤50	>0.2 and ≤2.0	>50 and ≤200
III	>50 and ≤300	>2.0 and ≤4.0	>200 and ≤1000

a. Tear gas substances must be included in Packing Group II even if their toxicity data correspond to Packing Group III values.

Table 2-9. Criteria for inhalation

Packing Group I	$V \geq 10\ LC_{50}$ and $LC_{50} \leq 1\ 000\ mL/m^3$
Packing Group II	$V \geq LC_{50}$ and $LC_{50} \leq 3\ 000\ mL/m^3$ and not meeting the criteria for Packing Group I
Packing Group III	$V \geq 0.2\ LC_{50}$ and $LC_{50} \leq 5\ 000\ mL/m^3$ and not meeting the criteria for Packing Groups I and II

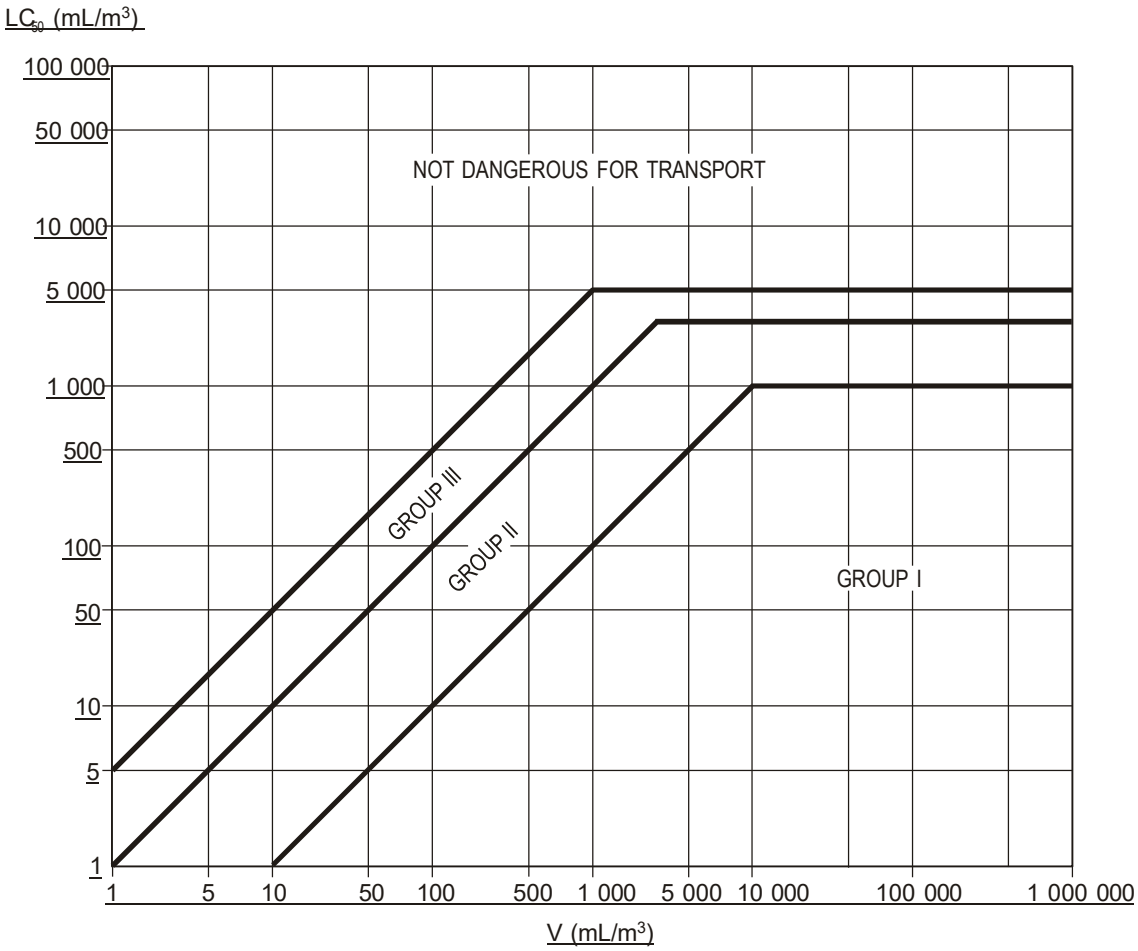

Figure 2-1. Criteria for inhalation of vapours

6.2.2.4.5 The criteria for inhalation toxicity of vapours in 6.2.2.4.3 are based on LC_{50} data relating to 1-hour exposures, and where such information is available, it must be used. However, where only LC_{50} data relating to 4-hour exposures to the vapours are available, such figures can be multiplied by two and the product substituted in the above criteria, that is, LC_{50} (4 h) × 2 is considered the equivalent of LC_{50} (1 h).

6.2.2.4.6 Mixtures of liquids that are toxic by inhalation must be assigned to packing groups according to 6.2.2.4.7 or 6.2.2.4.8.

6.2.2.4.7 If LC_{50} data is available for each of the toxic substances comprising a mixture, the packing group may be determined as follows:

a) Estimate the LC_{50} of the mixture using the formula:

$$LC_{50}\ (\text{mixture}) = \frac{1}{\sum_{i=1}^{n} \frac{f_i}{}}$$

$\sum_{i=1} \frac{}{LC_{50_i}}$

where f_i = mole fraction of the i^{th} component substance of the liquid, and

where LC_{50_i} = mean lethal concentration of the i^{th} component substance in mL/m^3

b) Estimate the volatility of each component substance using the formula:

$$V_i = \left(\frac{P_i \times 10^6}{101.3}\right) ml/m^3$$

where P_i = Segmential pressure of the i^{th} component substance in kPa at 20°C and one atmosphere pressure.

c) Calculate the ratio of the volatility to the LC_{50} using the formula:

$$R = \frac{\sum_{i=1}^{n} V_i}{\sum_{i=1} LC_{50_i}}$$

d) Using the calculated values LC_{50} (mixture) and R, the packing group

for the mixture is determined: Packing Group I: R ≥ 10 and LC_{50}

(mixture) ≤ 1 000 mL/m^3

Packing Group II: R ≥ 1 and LC_{50} (mixture) ≤ 3 000 mL/m^3 and not meeting criteria for Group I

Packing Group III: R ≥ 1/5 and LC_{50} (mixture) ≤ 5 000 mL/m^3 and not meeting criteria for Group I or II.

6.2.2.4.8 In the absence of LC_{50} data on the toxic constituent substances, the mixture may be assigned to a packing group based on the following simplified threshold toxicity tests. When these threshold tests are used, the most restrictive packing group must be determined and used for transporting the mixture.

a) A mixture is assigned to Packing Group I only if it meets both of the following criteria:

i)

A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 1 000 mL/m3 vaporized mixture in air.
Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days.
If 5 or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC50 equal to or less than 1 000 mL/m3.

ii) .

A sample of the vapour in equilibrium with the liquid mixture at 20°C is diluted with 9 equal volumes of air to form a test atmosphere.
Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days
If 5 or more of the animals die within the 14-day observation period, the mixture

is presumed to have a volatility equal to or greater than 10 times the mixture LC50.

b) A mixture is assigned to Packing Group II only if it meets both of the following criteria, and the mixture does not meet the criteria for Packing Group I:

i) .

A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 3 000 mL/m3 vaporized mixture in air.
Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days
If 5 or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC50 equal to or less than 3 000 mL/m3.

ii)

A sample of the vapour in equilibrium with the liquid mixture at 20°C is used to form a test atmosphere
Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 day
If 5 or more of the animals die within the 14-day observation period, the mixture is presumed to have a volatility equal to or greater than the mixture LC50.

c) A mixture is assigned to Packing Group III only if it meets both of the following criteria, and the mixture does not meet the criteria for Packing Groups I or II:

A sample of the liquid mixture is vaporized and diluted with air to create a test atmosphere of 5 000 mL/m3 vaporized mixture in air.
Ten albino rats (5 male and 5 female) are exposed to the test atmosphere for 1 hour and observed for 14 days
If 5 or more of the animals die within the 14-day observation period, the mixture is presumed to have an LC50 equal to or less than 5 000 mL/m3.
The vapour pressure of the liquid mixture is measured and if the vapour pressure is equal to or greater than 1 000 mL/m3, the mixture is presumed to have a volatility equal to or greater than 1/5 the mixture LC50.

6.2.3 Methods for determining oral and dermal toxicity of mixtures

6.2.3.1 When classifying and assigning the appropriate packing group to mixtures in Division 6.1, in accordance with the oral and dermal toxicity criteria in Table 2-8, it is necessary to determine the acute LD_{50} of the mixture.

6.2.3.2 If a mixture contains only one active substance, and the LD_{50} of that constituent is known, in the absence of reliable acute oral and dermal toxicity data on the actual mixture to be transported, the oral or dermal LD_{50} may be obtained by the following method:

LD_{50} value of preparation =

$$\frac{LD_{50} \text{ value of active substance} \times 100}{\text{percentage of active substance by mass}}$$

6.2.3.3 If a mixture contains more than one active constituent, there are three possible approaches that may be used to determine the oral or dermal LD_{50} of the mixture. The preferred method is to obtain reliable acute oral and dermal toxicity data on the actual mixture to be transported. If reliable and accurate data are not available, then either of the following methods may be performed:

a) classify the formulation according to the most hazardous constituent of the mixture as if that constituent were present in the same concentration as the total concentration of all active constituents; or

b) apply the formula:

$$\frac{C_A}{T_A} \pm \frac{C_B}{T_B} \pm \frac{C_Z}{T_Z} = \frac{100}{T_M}$$

where:

C = the per cent concentration of constituent A, B ... Z in the mixture

T = the oral LD_{50} values of constituent A, B ... Z

T_M = the oral LD_{50} value of the mixture.

Note. — This formula can also be used for dermal toxicities provided that this information is available on the same species for all constituents. The use of this formula does not take into account any potentiation or protective phenomena.

6.2.4 Classification of pesticides

6.2.4.1 All active pesticide substances and their preparations for which the LC_{50} and/or LD_{50} values are known and which are classified in Division 6.1 must be classified under appropriate packing groups in accordance with the criteria given in 6.2.2. Substances and preparations which are characterized by subsidiary hazards must be classified according to the precedence of hazards table (Table 2-1) with the assignment of appropriate packing groups.

6.2.4.2 If the oral or dermal LD_{50} value for a pesticide preparation is not known, but the LD_{50} value of its active substance(s) is known, the LD_{50} value for the preparation may be obtained by applying the procedures in 6.2.3.

Note. — LD_{50} toxicity data for several common pesticides may be obtained from the most current edition of the document The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification *available from the International Programme on Chemical Safety, World Health Organization (WHO), 1211 Geneva 27, Switzerland. While that document may be used as a source of LD_{50} data for pesticides, its classification system should not be used for purposes of transport classification of, or assignment of packing groups to, pesticides which must be in accordance with these Instructions.*

6.2.4.3 The proper shipping name used in the transport of the pesticide must be selected on the basis of the active ingredient, of the physical state of the pesticide and any subsidiary hazards it may exhibit.

6.2.5 Substances forbidden for transport

Chemically unstable substances of Division 6.1 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization, see Special Provision A209. To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

6.3 DIVISION 6.2 – INFECTIOUS SUBSTANCES

6.3.1 Definitions

For the purposes of these Instructions:

6.3.1.1 *Infectious substances* are substances which are known to contain, or are reasonably expected to contain, pathogens. Pathogens are defined as micro-organisms (including bacteria, viruses, parasites, fungi) and other agents such as prions, which can cause disease in humans or animals.

6.3.1.2 *Biological products* are those products derived from living organisms which are manufactured and distributed in accordance with the requirements of appropriate national authorities, which may have special licensing requirements, and are used either for prevention, treatment or diagnosis of disease in humans or animals, or for development, experimental or investigational purposes related thereto. They include, but are not limited to, finished or unfinished products such as vaccines.

6.3.1.3 *Cultures* are the result of a process by which pathogens are intentionally propagated. This definition does not include patient specimens as defined in 6.3.1.4.

6.3.1.4 *Patient specimens* are those collected directly from humans or animals, including, but not limited to,

6.3.1.5 excreta, secreta, blood and its components, tissue and tissue fluid swabs, and body parts being transported for purposes such as research, diagnosis, investigational activities, and disease treatment and prevention.

6.3.1.6 *Medical or clinical wastes* are wastes derived from the veterinary treatment of animals, the medical treatment of humans or from bioresearch.

6.3.2 Classification of infectious substances

6.3.2.1 Infectious substances must be classified in Division 6.2 and assigned to:

UN 2814

UN 2900

UN 3291

UN 3373

UN 3549 (as appropriate.)

6.3.2.2 Infectious substances are divided into the following categories:

6.3.2.2.1 *Category A:* An infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals. Indicative examples of substances that meet these criteria are given in Table 2-10.

Note.— An exposure occurs when an infectious substance is released outside of the protective packaging resulting in physical contact with humans or animals.

a) Infectious substances meeting these criteria which cause disease in humans or in both humans and animals must be assigned to UN 2814. Infectious substances which cause disease only in animals must be assigned to UN 2900.

b) Assignments to UN 2814 or UN 2900 must be based on the known medical history and symptoms of the source human or animal, endemic local conditions, or professional judgement concerning individual circumstances of the source human or animal.

Note 1. *The proper shipping name for UN 2814 is* ***Infectious substance, affecting humans.*** *The proper shipping name for UN 2900 is* ***Infectious substance, affecting animals*** *only*.

Note 2. *Table 2-10 is not exhaustive. Infectious substances, including new or emerging pathogens, which do not appear in Table 2-10 but which meet the same criteria must be assigned to Category A. In addition, if there is doubt as to whether or not a substance meets the criteria it must be included in Category A*.

Note 3*. In Table 2-10, the micro-organisms written in italics are bacteria or fungi.*

6.3.2.2.2 *Category B:* An infectious substance which does not meet the criteria for inclusion in Category A. Infectious substances in Category B must be assigned to UN 3373.

*Note.— The proper shipping name of UN 3373 is **Biological substance, Category B**.*

6.3.2.3 *Exceptions*

6.3.2.3.1 Substances which do not contain infectious substances or substances which are unlikely to cause disease in humans or animals are not subject to these Technical Standardsunless they meet the criteria for inclusion in another class.

6.3.2.3.2 Substances containing micro-organisms which are non-pathogenic to humans or animals are not subject to these Technical Standardsunless they meet the criteria for inclusion in another class.

6.3.2.3.3 Substances in a form that any present pathogens have been neutralized or inactivated such that they no longer pose a health risk are not subject to these Technical Standards unless they meet the criteria for inclusion in another class.

6.3.2.3.4 Environmental samples (including food and water samples) which are not considered to pose a significant risk of infection are not subject to these Technical Standards unless they meet the criteria for inclusion in another class.

Table 2-10. Indicative examples of infectious substances included in Category A in any form unless otherwise indicated (6.3.2.2.1 a))

Micro-organism	UN Number and Proper Shipping Name
Bacillus anthracis (cultures only) *Brucella abortus (cultures only)* *Brucella melitensis (cultures only)* *Brucella suis (cultures only)* *Burkholderia mallei – Pseudomonas mallei –* Glanders *(cultures only)* *Burkholderia pseudomallei – Pseudomonas pseudomallei (cultures only)* *Chlamydia psittaci* – avian strains (cultures only) *Clostridium botulinum (cultures only)* *Coccidioides immitis (cultures only)* *Coxiella burnetii (cultures only)* Crimean-Congo hemorrhagic fever virus Dengue virus (cultures only) Eastern equine encephalitis virus (cultures only) *Escherichia coli*, verotoxigenic (cultures only) Ebola virus Flexal virus *Francisella tularensis (cultures only)* Guanarito virus Hantaan virus Hantaviruses causing haemorrhagic fever with renal syndrome Hendra virus Hepatitis B virus (cultures only) Herpes B virus (cultures only) Highly pathogenic avian influenza virus (cultures only) Human immunodeficiency virus (cultures only) Japanese Encephalitis virus (cultures only) Junin virus Kyasanur Forest disease virus Lassa virus Machupo virus Marburg virus Monkeypox virus (cultures only)[1] *Mycobacterium tuberculosis (cultures only)* Nipah virus Omsk hemorrhagic fever virus Poliovirus (cultures only) Rabies virus (cultures only) *Rickettsia prowazekii (cultures only)* *Rickettsia rickettsii* (cultures only) Rift Valley fever virus (cultures only) Russian spring-summer encephalitis virus (cultures only) Sabia virus *Shigella dysenteriae type 1 (cultures only)* Tick-borne encephalitis virus (cultures only) Variola virus Venezuelan equine encephalitis virus (cultures only) West Nile virus (cultures only) Yellow fever virus (cultures only) *Yersinia pestis* (cultures only)	African swine fever virus (cultures only) Avian paramyxovirus Type 1 – Velogenic Newcastle disease virus (cultures only) Classical swine fever virus (cultures only) Foot and mouth disease virus (cultures only) Goatpox virus (cultures only)

1. “Monkeypox” was renamed “mpox” by the WHO.

6.3.2.3.5 Dried blood spots, collected by applying a drop of blood onto absorbent material, are not subject to these Instructions.

6.3.2.3.6 Faecal occult blood screening samples are not subject to these Instructions.

6.3.2.3.7 Blood or blood components that have been collected for the purposes of transfusion or for the preparation of blood products to be used for transfusion or transplantation and any tissues or organs intended for use in transplantation as well as samples drawn in connection with such purposes are not subject to these Instructions.

6.3.2.3.8 Patient specimens for which there is minimal likelihood that pathogens are present are not subject to other provisions of these Technical Standardsprovided the following conditions are met:

a) The specimen must be transported in a packaging which will prevent any leakage and which must be marked with the words “Exempt human specimen” or “Exempt animal specimen”, as appropriate;

b) The packaging must consist of three components:

i) a leakproof primary receptacle(s);

ii) an outer packaging of adequate strength for its capacity, mass and intended use, and with at least one surface having minimum dimensions of 100 mm × 100 mm;

iii) a leakproof secondary packaging; and

c) For liquids, absorbent material in sufficient quantity to absorb the entire contents must be placed between the primary receptacle(s) and the secondary packaging so that, during transport, any release or leak of a liquid substance will not reach the outer packaging and will not compromise the integrity of the cushioning material;

d) When multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them.

e) If refrigerated or frozen specimens are to be transported, the following conditions must be met:

i) the primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

iii) when dry ice or liquid nitrogen is used to keep specimens cold, all applicable requirements of these Technical Standards must be met. When used, ice or dry ice must be placed outside the secondary packaging or in the outer packaging. Interior supports must be provided to secure the secondary packaging in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging must be leakproof. If carbon dioxide, solid (dry ice) is used, the packaging must be designed and constructed to permit the release of carbon dioxide gas to prevent a build-up of pressure that could rupture the packagings;

Note. — In determining whether a patient specimen has a minimum likelihood that pathogens are present, an element of professional judgement is required to determine if a substance is exempt under this paragraph. That judgement should be based on:

- *the known medical history,*
- *symptoms and individual circumstances of the source,*
- *human or animal, and*
- *endemic local conditions.*
- *Examples of specimens which may be transported under this paragraph include*

  1)blood or urine tests to monitor cholesterol levels,

  2)blood glucose levels,

  3)hormone levels, or prostate specific antibodies (PSA);

  4)tests required to monitor organ function such as heart, liver or kidney function for humans or animals with non-infectious diseases, or

  5)therapeutic drug monitoring;

  6)tests conducted for insurance or employment purposes and are intended to determine the presence of drugs or alcohol;

  7)pregnancy tests;

  8)biopsies to detect cancer; and

  9)antibody detection in humans or animals in the absence of any concern for infection (such as evaluation of vaccine induced immunity, diagnosis of autoimmune disease, etc.).

6.3.2.3.9 Except for:

a) medical waste (UN 3291 and UN 3549);

b) medical devices or equipment contaminated with or containing infectious substances in Category A (UN 2814 or UN 2900); and

c) medical devices or equipment contaminated with or containing other dangerous goods that meet the definition of another hazard class,

medical devices or equipment potentially contaminated with or containing infectious substances which are being transported for disinfection, cleaning, sterilization, repair, or equipment evaluation are not subject to the provisions of these Technical Standards if packed in packagings designed and constructed in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents. Packagings must be designed to meet the construction requirements listed in 6;3.

6.3.2.3.9.1 Medical devices or equipment must be drained of free liquid to the extent practicable. They must be packed in a strong rigid outer packaging fitted with sufficient cushioning material to prevent movement within the outer packaging. These packagings must meet the general packing requirements of Segment 4. If the

outer packaging is not liquid tight and the medical devices or equipment are contaminated with or contain liquid infectious substances, a means of containing the liquid in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally effective means of containment. These packagings must be capable of retaining the medical devices and equipment when dropped from a height of 1.2 m.

Note.— A packaging's capability of retaining medical devices or equipment when dropped from a height of 1.2 m should be determined through testing a sample package as prepared for transport or through alternative means such as non-destructive testing and engineering analysis, testing with an article of similar mass and size, or other equivalent means.

6.3.2.3.9.2 Packages must be marked "Used medical device" or "Used medical equipment". When an overpack is used, it must be marked with the words "Used medical device" or "Used medical equipment" unless the markings are visible.

6.3.3 Biological products

For the purposes of these Instructions, biological products are divided into the following groups:

a) Those which are manufactured and packaged in accordance with the requirements of appropriate national authorities and transported for the purposes of final packaging or distribution and use for personal health care by medical professionals or individuals. Substances in this group are not subject to these Instructions.

b) Those which do not fall under paragraph a) and are known or reasonably believed to contain infectious substances and which meet the criteria for inclusion in Category A or Category B. Substances in this group must be assigned to UN 2814, UN 2900 or UN 3373, as appropriate.

Note. — Some licensed biological products may present a biohazard only in certain parts of the world. In that case, appropriate national authorities may require these biological products to be in compliance with local requirements for infectious substances or may impose other restrictions.

6.3.4 Genetically modified micro-organisms and organisms

Genetically modified micro-organisms not meeting the definition of infectious substances must be classified according to Section 9.

6.3.5 Medical or clinical wastes

6.3.5.1 Medical or clinical wastes containing:

a) Category A infectious substances must be assigned to UN 2814, UN 2900 or UN 3549, as appropriate. Solid medical waste containing Category A infectious substances generated from the medical treatment of humans or veterinary treatment of animals may be assigned to UN 3549. The UN 3549 entry must not be used for waste from bio-research or liquid waste.

b) Category B infectious substances must be assigned to UN 3291.

6.3.5.2 Medical or clinical wastes that are reasonably believed to have a low

probability of containing infectious substances must be assigned to UN 3291. For the assignment, international, regional or national waste catalogues may be taken into account.

Note.— The proper shipping name for UN 3291 is ***Clinical waste, unspecified, n.o.s.*** *or* ***Biomedical waste, n.o.s.*** *or* ***Medical waste, n.o.s.*** *or* ***Regulated medical waste, n.o.s.***

6.3.5.3 Decontaminated medical or clinical wastes that previously contained infectious substances are not subject to these Technical Standardsunless they meet the criteria for inclusion in another class.

6.3.6 Infected animals

6.3.6.1 *Infected live animals*

Live animals must not be used to consign infectious substances unless such a substance cannot be consigned by any other means. A live animal that has been intentionally infected and is known or suspected to contain an infectious substance may only be transported by air under the terms and conditions of an approval granted by the appropriate national authorities of the States of Origin, Transit, Destination and Operator.

6.3.6.2 *Deleted*

6.3.7 Patient specimens

Patient specimens must be assigned to UN 2814, UN 2900 or UN 3373 as appropriate except if they comply with 6.3.2.3.

Section 7

CLASS 7 – RADIOACTIVE MATERIAL

Note. — For Class 7, the type of packaging may have a decisive effect on classification.

7.1 DEFINITIONS

7.1.1 *Radioactive material*. Any material containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 7.2.2.1 to 7.2.2.6.

7.1.2 Contamination

Contamination. The presence of a radioactive substance on a surface in quantities in excess of 0.4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.04 Bq/cm^2 for all other alpha emitters.

Non-fixed contamination. Contamination that can be removed from a surface during routine conditions of transport.

Fixed contamination. Contamination other than non-fixed contamination.

7.1.3 Definitions of specific terms

A_1 and *A_2:*

A_1. The activity value of special form radioactive material, which is listed in Table 2-12 or derived in 7.2.2.2 and is used to determine the activity limits for the requirements of these Instructions.

A_2. The activity value of radioactive material, other than special form radioactive material, which is listed in Table 2-12 or derived in 7.2.2.2 and is used to determine the activity limits for the requirements of these Instructions.

Fissile nuclides. Uranium-233, uranium-235, plutonium-239 and plutonium-241. Fissile material is a material containing any of the fissile nuclides. Excluded from the definition of fissile material are the following:

a) natural uranium or depleted uranium which is unirradiated;

b) natural uranium or depleted uranium which has been irradiated in thermal reactors only;

c) material with fissile nuclides less than a total of 0.25 g;

d) any combination of a), b) and/or c).

These exclusions are only valid if there is no other material with fissile nuclides in the package.

Freight container in the case of radioactive material transport. An article of transport equipment designed to:

- facilitate the transport of packaged goods by one or more modes of transport without intermediate reloading, which is of a permanent enclosed character,
- rigid and strong enough for repeated use, and must be fitted with devices facilitating its handling, Segmenticularly in transfer between aircraft and from one mode of transport to another.
- In addition, a small freight container is that which has an internal volume of not more than 3 m^3.
- A large freight container is that which has an internal volume of more than 3 m^3.
- For the transport of radioactive material, a freight container may be used as a packaging.

Low dispersible radioactive material. A solid radioactive material or a solid radioactive material in a sealed capsule, that has limited dispersibility and is not in powder form.

Low specific activity (LSA) material. Radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average specific activity apply. External shielding materials surrounding the LSA material must not be considered in determining the estimated average specific activity.

Low toxicity alpha emitters. Natural uranium; depleted uranium; natural thorium; uranium-235 or uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical and chemical concentrates; or alpha emitters with a half-life of less than 10 days.

Packaging in the case of radioactive material. The assembly of components necessary to enclose the radioactive contents completely. It may, in particular, consist of:

—

- one or more receptacles,
- absorbent materials,
- spacing structures,
- radiation shielding and service equipment for filling, emptying, venting and pressure relief;
- devices for cooling,
- absorbing mechanical shocks,
- handling and tie-down, thermal insulation; and service devices integral to the package.
- The packaging may be a box, drum or similar receptacle, or may also be a freight container.

Note. — For packagings for other dangerous goods, see definitions under 1;3.1.1.

Special form radioactive material. Either:

a) a sealed capsule containing radioactive material.

b) an indispersible solid radioactive material; or

Specific activity of a radionuclide. The activity per unit mass of that nuclide. The specific activity of a material must mean the activity per unit mass of the material in which the

radionuclides are essentially uniformly distributed.

+ *Note.— The terms "activity concentration" and "specific activity" are synonymous for the purpose of these Instructions.*

Surface contaminated object (SCO). A solid object which is not itself radioactive but which has radioactive material distributed on its surface.

Transport index (TI) assigned to a package, overpack or freight container, or to unpackaged LSA-I, SCO-I or SCO-III. A number which is used to provide control over radiation exposure.

*Note. — Unpackaged **LSA-I, SCO-I or SCO-III** material are not permitted for transport by air.*

***Unirradiated Thorium*.** Thorium containing not more than 10^{-7} g of uranium-233 per gram of thorium-232.

***Unirradiated Uranium*.** Uranium containing not more than 2×10^{3} Bq of plutonium per gram of uranium-235, not more than 9×10^{6} Bq of fission products per gram of uranium-235 and not more than 5×10^{-3} g of uranium-236 per gram of uranium-235.

***Uranium –** natural, depleted, enriched*:

Natural Uranium. Uranium (which may be chemically separated) containing the naturally occurring distribution of uranium isotopes (approximately 99.28 per cent uranium-238, and 0.72 per cent uranium-235 by mass).

Depleted Uranium. Uranium containing a lesser mass percentage of uranium-235 than in natural uranium.

***Enriched Uranium*.** Uranium containing a greater mass percentage of uranium-235 than 0.72 per cent. In all cases, a very small mass percentage of uranium-234 is present.

7.2 CLASSIFICATION

7.2.1 General provisions

7.2.1.1 Radioactive material must be assigned to one of the UN numbers specified in Table 2-11 in accordance with 7.2.4 to 7.2.5, taking into account the material characteristics determined in 7.2.3.

Table 2-11. Assignment of UN numbers

UN number	***Proper Shipping Name and Description*[a]**
Excepted packages (1;6.1.5)	
UN 2908	**Radioactive material, excepted package – empty packaging**
UN 2909	**Radioactive material, excepted package – articles manufactured from natural uranium** or **depleted uranium** or **natural thorium**
UN 2910	**Radioactive material, excepted package – limited quantity of material**
UN 2911	**Radioactive material, excepted package – instruments** or **articles**

UN 3507	**Uranium hexafluoride, radioactive material, excepted package**, less than 0.1 kg per package, non-fissile or fissile-excepted[b,c]
Low specific activity radioactive material (7.2.3.1)	

UN number	*Proper Shipping Name and Description*[a]
UN 2912	**Radioactive material, low specific activity (LSA-I)**, non-fissile or fissile excepted[b]
UN 3321	**Radioactive material, low specific activity (LSA-II)**, non-fissile or fissile excepted[b]
UN 3322	**Radioactive material, low specific activity (LSA-III)**, non-fissile or fissile excepted[b]
UN 3324	**Radioactive material, low specific activity (LSA-II) fissile**
UN 3325	**Radioactive material, low specific activity (LSA-III) fissile**
Surface contaminated objects (7.2.3.2)	
UN 2913	**Radioactive material, surface contaminated objects (SCO-I, SCO-II** or **SCO-III)**, non-fissile or fissile excepted[b]
UN 3326	**Radioactive material, surface contaminated objects (SCO-I** or **SCO-II), fissile**
Type A packages (7.2.4.4)	
UN 2915	**Radioactive material, Type A package**, non-special form, non-fissile or fissile excepted[b]
UN 3327	**Radioactive material, Type A package, fissile**, non-special form
UN 3332	**Radioactive material, Type A package, special form**, non-fissile or fissile excepted[b]
UN 3333	**Radioactive material, Type A package, special form, fissile**
Type B(U) package (7.2.4.6)	
UN 2916	**Radioactive material, Type B(U) package**, non-fissile or fissile excepted[b]
UN 3328	**Radioactive material, Type B(U) package, fissile**
Type B(M) package (7.2.4.6)	
UN 2917	**Radioactive material, Type B(M) package**, non-fissile or fissile excepted[b]
UN 3329	**Radioactive material, Type B(M) package, fissile**
Type C package (7.2.4.6)	
UN 3323	**Radioactive material, Type C package**, non-fissile or fissile excepted[b]
UN 3330	**Radioactive material, Type C package, fissile**
Special arrangement (7.2.5)	
UN 2919	**Radioactive material, transported under special arrangement**, non-fissile or fissile excepted[b]
UN 3331	**Radioactive material, transported under special arrangement, fissile**
Uranium hexafluoride (7.2.4.5)	
UN 2977	**Radioactive material, uranium hexafluoride, fissile**
UN 2978	**Radioactive material, uranium hexafluoride**, non-fissile or fissile excepted[b]
UN 3507	**Uranium hexafluoride, radioactive material, excepted package,** less than 0.1 kg per package, non-fissile or fissile-excepted[b,c]

a. The proper shipping name is found in the column "proper shipping name and description" and is restricted to that SEGMENT shown in bold letters. In the cases of UN Nos. 2909, 2911, 2913 and 3326, where alternative proper shipping names are separated by the word "or", only the relevant proper shipping name must be used.

b. The term "fissile-excepted" refers only to material excepted under 7.2.3.5.

c. For UN No. 3507, see also Special Provision A194.

7.2.2 Determination of basic radionuclide values

7.2.2.1 The following basic values for individual radionuclides are given in Table 2-12:

a) A_1 and A_2 in TBq;

b) activity limits for exempt consignments in B

c) activity concentration limits for exempt material in Bq/g; and

7.2.2.2 For individual radionuclides:

a) which are not listed in Table 2-12, determination of the basic radionuclide values referred to in 7.2.2.1 requires multilateral approval. For these radionuclides, activity concentration limits for exempt material and activity limits for exempt consignments must be calculated in accordance with the principles established in the Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No.GSR Part 3, IAEA, Vienna (2014). It is permissible to use the A_2 value calculated using a dose coefficient for the appropriate lung absorption type as recommended by the International Commission on Radiological Protection, if the chemical forms of each radionuclide under both normal and accident conditions of transport are taken into consideration. Alternatively, the radionuclide values in Table 2-13 may be used without obtaining competent authority approval.

b) in instruments or articles in which the radioactive material is enclosed or is included as a component SEGMENT of the instrument or other manufactured article and which meet 7.2.4.1.1.3 c), alternative basic radionuclide values to those in Table 2-12 for the activity limit for an exempt consignment are permitted and require multilateral approval. Such alternative activity limits for an exempt consignment must be calculated in accordance with the principles set out in GSR SEGMENT 3.

7.2.2.3 In the calculations of A_1 and A_2 for a radionuclide not in Table 2-12, a single radioactive decay chain in which the radionuclides are present in their naturally occurring proportions, and in which no progeny nuclide has a half-life either longer than 10 days or longer than that of the parent nuclide, must be considered as a single radionuclide; and the activity to be taken into account and the A_1 or A_2 value to be applied must be that corresponding to the parent nuclide of that chain. In the case of radioactive decay chains in which any progeny nuclide has a half-life either longer than 10 days or greater than that of the parent nuclide, the parent and such progeny nuclides must be considered as mixtures of different nuclides.

7.2.2.4 For mixtures of radionuclides, the basic radionuclide values referred to in 7.2.2.1 may be determined as follows:

$$X_m = \frac{1}{\sum \frac{f(i)}{}}$$

$_i$ X(i)

where,

f(i) is the fraction of activity or activity concentration of radionuclide i in the mixture;

X(i) is the appropriate value of A_1 or A_2 or the activity concentration limit for exempt material or the activity limit for an exempt consignment as appropriate for the radionuclide i; and

X_m is the derived value of A_1 or A_2 or the activity concentration limit for exempt material or the activity limit for an exempt consignment in the case of a mixture.

7.2.2.5 When the identity of each radionuclide is known but the individual activities of some of the radionuclides are not known, the radionuclides may be grouped and the lowest radionuclide value, as appropriate, for the radionuclides in each group may be used in applying the formulas in 7.2.2.4 and 7.2.4.4. Groups may be based on the total alpha activity and the total beta/gamma activity when these are known, using the lowest radionuclide values for the alpha emitters or beta/gamma emitters, respectively.

7.2.2.6 For individual radionuclides or for mixtures of radionuclides for which relevant data are not available, the values shown in Table 2-13 must be used.

Table 2-12. Basic radionuclides values for individual radionuclides

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Actinium (89)				
Ac-225 (a)	8×10^{-1}	6×10^{-3}	1×10^{4}	1×10^{1}
Ac-227 (a)	9×10^{-1}	9×10^{-5}	1×10^{3}	1×10^{-1}
Ac-228	6×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Silver (47)				
Ag-105	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Ag-108m (a)	7×10^{-1}	7×10^{-1}	1×10^{6} (b)	1×10^{1} (b)
Ag-110m (a)	4×10^{-1}	4×10^{-1}	1×10^{6}	1×10^{1}
Ag-111	2×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Aluminium (13)				
Al-26	1×10^{-1}	1×10^{-1}	1×10^{5}	1×10^{1}
Americium (95)				
Am-241	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{0}
Am-242m (a)	1×10^{1}	1×10^{-3}	1×10^{4} (b)	1×10^{0} (b)
Am-243 (a)	5×10^{0}	1×10^{-3}	1×10^{3} (b)	1×10^{0} (b)
Argon (18)				
Ar-37	4×10^{1}	4×10^{1}	1×10^{8}	1×10^{6}
Ar-39	4×10^{1}	2×10^{1}	1×10^{4}	1×10^{7}
Ar-41	3×10^{-1}	3×10^{-1}	1×10^{9}	1×10^{2}
Arsenic (33)				
As-72	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
As-73	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{3}

As-74	1×10^{0}	9×10^{-1}	1×10^{6}	1×10^{1}
As-76	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{2}
As-77	2×10^{1}	7×10^{-1}	1×10^{6}	1×10^{3}
Astatine (85)				
At-211 (a)	2×10^{1}	5×10^{-1}	1×10^{7}	1×10^{3}
Gold (79)				
Au-193	7×10^{0}	2×10^{0}	1×10^{7}	1×10^{2}
Au-194	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Au-195	1×10^{1}	6×10^{0}	1×10^{7}	1×10^{2}
Au-198	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Au-199	1×10^{1}	6×10^{-1}	1×10^{6}	1×10^{2}
Barium (56)				
Ba-131 (a)	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Ba-133	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Ba-133m	2×10^{1}	6×10^{-1}	1×10^{6}	1×10^{2}
Ba-135m	2×10^{1}	6×10^{-1}	1×10^{6}	1×10^{2}
Ba-140 (a)	5×10^{-1}	3×10^{-1}	1×10^{5} (b)	1×10^{1} (b)
Beryllium (4)				
Be-7	2×10^{1}	2×10^{1}	1×10^{7}	1×10^{3}
Be-10	4×10^{1}	6×10^{-1}	1×10^{6}	1×10^{4}
Bismuth (83)				
Bi-205	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Bi-206	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Bi-207	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Bi-210	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Bi-210m(a)	6×10^{-1}	2×10^{-2}	1×10^{5}	1×10^{1}
Bi-212 (a)	7×10^{-1}	6×10^{-1}	1×10^{5} (b)	1×10^{1} (b)
Berkelium (97)				
Bk-247	8×10^{0}	8×10^{-4}	1×10^{4}	1×10^{0}
Bk-249 (a)	4×10^{1}	3×10^{-1}	1×10^{6}	1×10^{3}
Bromine (35)				
Br-76	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Br-77	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Br-82	4×10^{-1}	4×10^{-1}	1×10^{6}	1×10^{1}
Carbon (6)				
C-11	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{1}
C-14	4×10^{1}	3×10^{0}	1×10^{7}	1×10^{4}
Calcium (20)				
Ca-41	Unlimited	Unlimited	1×10^{7}	1×10^{5}
Ca-45	4×10^{1}	1×10^{0}	1×10^{7}	1×10^{4}
Ca-47 (a)	3×10^{0}	3×10^{-1}	1×10^{6}	1×10^{1}
Cadmium (48)				
Cd-109	3×10^{1}	2×10^{0}	1×10^{6}	1×10^{4}
Cd-113m	4×10^{1}	5×10^{-1}	1×10^{6}	1×10^{3}
Cd-115 (a)	3×10^{0}	4×10^{-1}	1×10^{6}	1×10^{2}
Cd-115m	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{3}
Cerium (58)				
Ce-139	7×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Ce-141	2×10^{1}	6×10^{-1}	1×10^{7}	1×10^{2}
Ce-143	9×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{2}
Ce-144 (a)	2×10^{-1}	2×10^{-1}	1×10^{5} (b)	1×10^{2} (b)

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Californium (98)				
Cf-248	4×10^{1}	6×10^{-3}	1×10^{4}	1×10^{1}
Cf-249	3×10^{0}	8×10^{-4}	1×10^{3}	1×10^{0}
Cf-250	2×10^{1}	2×10^{-3}	1×10^{4}	1×10^{1}
Cf-251	7×10^{0}	7×10^{-4}	1×10^{3}	1×10^{0}
Cf-252	1×10^{-1}	3×10^{-3}	1×10^{4}	1×10^{1}
Cf-253 (a)	4×10^{1}	4×10^{-2}	1×10^{5}	1×10^{2}
Cf-254	1×10^{-3}	1×10^{-3}	1×10^{3}	1×10^{0}
Chlorine (17)				
Cl-36	1×10^{1}	6×10^{-1}	1×10^{6}	1×10^{4}
Cl-38	2×10^{-1}	2×10^{-1}	1×10^{5}	1×10^{1}
Curium (96)				
Cm-240	4×10^{1}	2×10^{-2}	1×10^{5}	1×10^{2}
Cm-241	2×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}
Cm-242	4×10^{1}	1×10^{-2}	1×10^{5}	1×10^{2}
Cm-243	9×10^{0}	1×10^{-3}	1×10^{4}	1×10^{0}
Cm-244	2×10^{1}	2×10^{-3}	1×10^{4}	1×10^{1}
Cm-245	9×10^{0}	9×10^{-4}	1×10^{3}	1×10^{0}
Cm-246	9×10^{0}	9×10^{-4}	1×10^{3}	1×10^{0}
Cm-247 (a)	3×10^{0}	1×10^{-3}	1×10^{4}	1×10^{0}
Cm-248	2×10^{-2}	3×10^{-4}	1×10^{3}	1×10^{0}
Cobalt (27)				
Co-55	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Co-56	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Co-57	1×10^{1}	1×10^{1}	1×10^{6}	1×10^{2}
Co-58	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Co-58m	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{4}
Co-60	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Chromium (24)				
Cr-51	3×10^{1}	3×10^{1}	1×10^{7}	1×10^{3}
Caesium (55)				
Cs-129	4×10^{0}	4×10^{0}	1×10^{5}	1×10^{2}
Cs-131	3×10^{1}	3×10^{1}	1×10^{6}	1×10^{3}
Cs-132	1×10^{0}	1×10^{0}	1×10^{5}	1×10^{1}
Cs-134	7×10^{-1}	7×10^{-1}	1×10^{4}	1×10^{1}
Cs-134m	4×10^{1}	6×10^{-1}	1×10^{5}	1×10^{3}
Cs-135	4×10^{1}	1×10^{0}	1×10^{7}	1×10^{4}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Cs-136	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{1}
Cs-137 (a)	2×10^{0}	6×10^{-1}	1×10^{4} (b)	1×10^{1} (b)
Copper (29)				
Cu-64	6×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}
Cu-67	1×10^{1}	7×10^{-1}	1×10^{6}	1×10^{2}
Dysprosium (66)				
Dy-159	2×10^{1}	2×10^{1}	1×10^{7}	1×10^{3}
Dy-165	9×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{3}
Dy-166 (a)	9×10^{-1}	3×10^{-1}	1×10^{6}	1×10^{3}
Erbium (68)				
Er-169	4×10^{1}	1×10^{0}	1×10^{7}	1×10^{4}
Er-171	8×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{2}
Europium (63)				
Eu-147	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Eu-148	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Eu-149	2×10^{1}	2×10^{1}	1×10^{7}	1×10^{2}
Eu-150 (short-lived)	2×10^{0}	7×10^{-1}	1×10^{6}	1×10^{3}
Eu-150 (long-lived)	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Eu-152	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Eu-152m	8×10^{-1}	8×10^{-1}	1×10^{6}	1×10^{2}
Eu-154	9×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Eu-155	2×10^{1}	3×10^{0}	1×10^{7}	1×10^{2}
Eu-156	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Fluorine (9)				
F-18	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{1}
Iron (26)				
Fe-52 (a)	3×10^{-1}	3×10^{-1}	1×10^{6}	1×10^{1}
Fe-55	4×10^{1}	4×10^{1}	1×10^{6}	1×10^{4}
Fe-59	9×10^{-1}	9×10^{-1}	1×10^{6}	1×10^{1}
Fe-60 (a)	4×10^{1}	2×10^{-1}	1×10^{5}	1×10^{2}
Gallium (31)				
Ga-67	7×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Ga-68	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{1}
Ga-72	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Gadolinium (64)				
Gd-146 (a)	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Gd-148	2×10^{1}	2×10^{-3}	1×10^{4}	1×10^{1}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Gd-153	1×10^{1}	9×10^{0}	1×10^{7}	1×10^{2}
Gd-159	3×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Germanium (32)				
Ge-68 (a)	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{1}
Ge-69	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Ge-71	4×10^{1}	4×10^{1}	1×10^{8}	1×10^{4}
Ge-77	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Hafnium (72)				
Hf-172 (a)	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Hf-175	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Hf-181	2×10^{0}	5×10^{-1}	1×10^{6}	1×10^{1}
Hf-182	Unlimited	Unlimited	1×10^{6}	1×10^{2}
Mercury (80)				
Hg-194 (a)	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Hg-195m (a)	3×10^{0}	7×10^{-1}	1×10^{6}	1×10^{2}
Hg-197	2×10^{1}	1×10^{1}	1×10^{7}	1×10^{2}
Hg-197m	1×10^{1}	4×10^{-1}	1×10^{6}	1×10^{2}
Hg-203	5×10^{0}	1×10^{0}	1×10^{5}	1×10^{2}
Holmium (67)				
Ho-166	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{3}
Ho-166m	6×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Iodine (53)				
I-123	6×10^{0}	3×10^{0}	1×10^{7}	1×10^{2}
I-124	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
I-125	2×10^{1}	3×10^{0}	1×10^{6}	1×10^{3}
I-126	2×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}
I-129	Unlimited	Unlimited	1×10^{5}	1×10^{2}
I-131	3×10^{0}	7×10^{-1}	1×10^{6}	1×10^{2}
I-132	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
I-133	7×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
I-134	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
I-135 (a)	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Indium (49)				
In-111	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
In-113m	4×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
In-114m (a)	1×10^{1}	5×10^{-1}	1×10^{6}	1×10^{2}
In-115m	7×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Iridium (77)				
Ir-189 (a)	1×10^{1}	1×10^{1}	1×10^{7}	1×10^{2}
Ir-190	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Ir-192	1×10^{0}(c)	6×10^{-1}	1×10^{4}	1×10^{1}
Ir-193m	4×10^{1}	4×10^{0}	1×10^{7}	1×10^{4}
Ir-194	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{2}
Potassium (19)				
K-40	9×10^{-1}	9×10^{-1}	1×10^{6}	1×10^{2}
K-42	2×10^{-1}	2×10^{-1}	1×10^{6}	1×10^{2}
K-43	7×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Krypton (36)				
Kr-79	4×10^{0}	2×10^{0}	1×10^{5}	1×10^{3}
Kr-81	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{4}
Kr-85	1×10^{1}	1×10^{1}	1×10^{4}	1×10^{5}
Kr-85m	8×10^{0}	3×10^{0}	1×10^{10}	1×10^{3}
Kr-87	2×10^{-1}	2×10^{-1}	1×10^{9}	1×10^{2}
Lanthanum (57)				
La-137	3×10^{1}	6×10^{0}	1×10^{7}	1×10^{3}
La-140	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Lutetium (71)				
Lu-172	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Lu-173	8×10^{0}	8×10^{0}	1×10^{7}	1×10^{2}
Lu-174	9×10^{0}	9×10^{0}	1×10^{7}	1×10^{2}
Lu-174m	2×10^{1}	1×10^{1}	1×10^{7}	1×10^{2}
Lu-177	3×10^{1}	7×10^{-1}	1×10^{7}	1×10^{3}
Magnesium (12)				
Mg-28 (a)	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Manganese (25)				
Mn-52	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Mn-53	Unlimited	Unlimited	1×10^{9}	1×10^{4}
Mn-54	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Mn-56	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Molybdenum (42)				
Mo-93	4×10^{1}	2×10^{1}	1×10^{8}	1×10^{3}
Mo-99 (a)	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Nitrogen (7)				
N-13	9×10^{-1}	6×10^{-1}	1×10^{9}	1×10^{2}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Sodium (11)				
Na-22	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Na-24	2×10^{-1}	2×10^{-1}	1×10^{5}	1×10^{1}
Niobium (41)				
Nb-93m	4×10^{1}	3×10^{1}	1×10^{7}	1×10^{4}
Nb-94	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Nb-95	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Nb-97	9×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Neodymium (60)				
Nd-147	6×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Nd-149	6×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{2}
Nickel (28)				
Ni-57	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Ni-59	Unlimited	Unlimited	1×10^{8}	1×10^{4}
Ni-63	4×10^{1}	3×10^{1}	1×10^{8}	1×10^{5}
Ni-65	4×10^{-1}	4×10^{-1}	1×10^{6}	1×10^{1}
Neptunium (93)				
Np-235	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{3}
Np-236 (short-lived)	2×10^{1}	2×10^{0}	1×10^{7}	1×10^{3}
Np-236 (long-lived)	9×10^{0}	2×10^{-2}	1×10^{5}	1×10^{2}
Np-237	2×10^{1}	2×10^{-3}	1×10^{3} (b)	1×10^{0} (b)
Np-239	7×10^{0}	4×10^{-1}	1×10^{7}	1×10^{2}
Osmium (76)				
Os-185	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Os-191	1×10^{1}	2×10^{0}	1×10^{7}	1×10^{2}
Os-191m	4×10^{1}	3×10^{1}	1×10^{7}	1×10^{3}
Os-193	2×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Os-194 (a)	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{2}
Phosphorus (15)				
P-32	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{3}
P-33	4×10^{1}	1×10^{0}	1×10^{8}	1×10^{5}
Protactinium (91)				
Pa-230 (a)	2×10^{0}	7×10^{-2}	1×10^{6}	1×10^{1}
Pa-231	4×10^{0}	4×10^{-4}	1×10^{3}	1×10^{0}
Pa-233	5×10^{0}	7×10^{-1}	1×10^{7}	1×10^{2}
Lead (82)				
Pb-201	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Pb-202	4×10^{1}	2×10^{1}	1×10^{6}	1×10^{3}
Pb-203	4×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Pb-205	Unlimited	Unlimited	1×10^{7}	1×10^{4}
Pb-210 (a)	1×10^{0}	5×10^{-2}	1×10^{4} (b)	1×10^{1} (b)
Pb-212 (a)	7×10^{-1}	2×10^{-1}	1×10^{5} (b)	1×10^{1} (b)
Palladium (46)				
Pd-103 (a)	4×10^{1}	4×10^{1}	1×10^{8}	1×10^{3}
Pd-107	Unlimited	Unlimited	1×10^{8}	1×10^{5}
Pd-109	2×10^{0}	5×10^{-1}	1×10^{6}	1×10^{3}
Promethium (61)				
Pm-143	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Pm-144	7×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Pm-145	3×10^{1}	1×10^{1}	1×10^{7}	1×10^{3}
Pm-147	4×10^{1}	2×10^{0}	1×10^{7}	1×10^{4}
Pm-148m (a)	8×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Pm-149	2×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Pm-151	2×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Polonium (84)				
Po-210	4×10^{1}	2×10^{-2}	1×10^{4}	1×10^{1}
Praseodymium (59)				
Pr-142	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{2}
Pr-143	3×10^{0}	6×10^{-1}	1×10^{6}	1×10^{4}
Platinum (78)				
Pt-188 (a)	1×10^{0}	8×10^{-1}	1×10^{6}	1×10^{1}
Pt-191	4×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Pt-193	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{4}
Pt-193m	4×10^{1}	5×10^{-1}	1×10^{7}	1×10^{3}
Pt-195m	1×10^{1}	5×10^{-1}	1×10^{6}	1×10^{2}
Pt-197	2×10^{1}	6×10^{-1}	1×10^{6}	1×10^{3}
Pt-197m	1×10^{1}	6×10^{-1}	1×10^{6}	1×10^{2}
Plutonium (94)				
Pu-236	3×10^{1}	3×10^{-3}	1×10^{4}	1×10^{1}
Pu-237	2×10^{1}	2×10^{1}	1×10^{7}	1×10^{3}
Pu-238	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{0}
Pu-239	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{0}
Pu-240	1×10^{1}	1×10^{-3}	1×10^{3}	1×10^{0}
Pu-241 (a)	4×10^{1}	6×10^{-2}	1×10^{5}	1×10^{2}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Pu-242	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{0}
Pu-244 (a)	4×10^{-1}	1×10^{-3}	1 ×1 10^{4}	1×10^{0}
Radium (88)				
Ra-223 (a)	4×10^{-1}	7×10^{-3}	1×10^{5} (b)	1×10^{2} (b)
Ra-224 (a)	4×10^{-1}	2×10^{-2}	1×10^{5} (b)	1×10^{1}(b)
Ra-225 (a)	2×10^{-1}	4×10^{-3}	1×10^{5}	1×10^{2}
Ra-226 (a)	2×10^{-1}	3×10^{-3}	1×10^{4} (b)	1×10^{1} (b)
Ra-228 (a)	6×10^{-1}	2×10^{-2}	1×10^{5} (b)	1×10^{1} (b)
Rubidium (37)				
Rb-81	2×10^{0}	8×10^{-1}	1×10^{6}	1×10^{1}
Rb-83 (a)	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Rb-84	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Rb-86	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{2}
Rb-87	Unlimited	Unlimited	1×10^{7}	1×10^{4}
Rb(nat)	Unlimited	Unlimited	1×10^{7}	1×10^{4}
Rhenium (75)				
Re-184	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Re-184m	3×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}
Re-186	2×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Re-187	Unlimited	Unlimited	1×10^{9}	1×10^{6}
Re-188	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{2}
Re-189 (a)	3×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Re(nat)	Unlimited	Unlimited	1×10^{9}	1×10^{6}
Rhodium (45)				
Rh-99	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{1}
Rh-101	4×10^{0}	3×10^{0}	1×10^{7}	1×10^{2}
Rh-102	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Rh-102m	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Rh-103m	4×10^{1}	4×10^{1}	1×10^{8}	1×10^{4}
Rh-105	1×10^{1}	8×10^{-1}	1×10^{7}	1×10^{2}
Radon (86)				
Rn-222 (a)	3×10^{-1}	4×10^{-3}	1×10^{8} (b)	1×10^{1} (b)
Ruthenium (44)				
Ru-97	5×10^{0}	5×10^{0}	1×10^{7}	1×10^{2}
Ru-103 (a)	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Ru-105	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{1}
Ru-106 (a)	2×10^{-1}	2×10^{-1}	1×10^{5} (b)	1×10^{2} (b)

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Sulphur (16)				
S-35	4×10^{1}	3×10^{0}	1×10^{8}	1×10^{5}
Antimony (51)				
Sb-122	4×10^{-1}	4×10^{-1}	1×10^{4}	1×10^{2}
Sb-124	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{1}
Sb-125	2×10^{0}	1×10^{0}	1×10^{6}	1×10^{2}
Sb-126	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Scandium (21)				
Sc-44	5×10^{-1}	5×10^{-1}	1×10^{5}	1×10^{1}
Sc-46	5×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Sc-47	1×10^{1}	7×10^{-1}	1×10^{6}	1×10^{2}
Sc-48	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Selenium (34)				
Se-75	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Se-79	4×10^{1}	2×10^{0}	1×10^{7}	1×10^{4}
Silicon (14)				
Si-31	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{3}
Si-32	4×10^{1}	5×10^{-1}	1×10^{6}	1×10^{3}
Samarium (62)				
Sm-145	1×10^{1}	1×10^{1}	1×10^{7}	1×10^{2}
Sm-147	Unlimited	Unlimited	1×10^{4}	1×10^{1}
Sm-151	4×10^{1}	1×10^{1}	1×10^{8}	1×10^{4}
Sm-153	9×10^{0}	6×10^{-1}	1×10^{6}	1×10^{2}
Tin (50)				
Sn-113 (a)	4×10^{0}	2×10^{0}	1×10^{7}	1×10^{3}
Sn-117m	7×10^{0}	4×10^{-1}	1×10^{6}	1×10^{2}
Sn-119m	4×10^{1}	3×10^{1}	1×10^{7}	1×10^{3}
Sn-121m (a)	4×10^{1}	9×10^{-1}	1×10^{7}	1×10^{3}
Sn-123	8×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{3}
Sn-125	4×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{2}
Sn-126 (a)	6×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Strontium (38)				
Sr-82 (a)	2×10^{-1}	2×10^{-1}	1×10^{5}	1×10^{1}
Sr-83	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Sr-85	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Sr-85m	5×10^{0}	5×10^{0}	1×10^{7}	1×10^{2}
Sr-87m	3×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Sr-89	6×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{3}
Sr-90 (a)	3×10^{-1}	3×10^{-1}	1×10^{4} (b)	1×10^{2} (b)
Sr-91 (a)	3×10^{-1}	3×10^{-1}	1×10^{5}	1×10^{1}
Sr-92 (a)	1×10^{0}	3×10^{-1}	1×10^{6}	1×10^{1}
Tritium (1)				
T(H-3)	4×10^{1}	4×10^{1}	1×10^{9}	1×10^{6}
Tantalum (73)				
Ta-178 (long-lived)	1×10^{0}	8×10^{-1}	1×10^{6}	1×10^{1}
Ta-179	3×10^{1}	3×10^{1}	1×10^{7}	1×10^{3}
Ta-182	9×10^{-1}	5×10^{-1}	1×10^{4}	1×10^{1}
Terbium (65)				
Tb-149	8×10^{-1}	8×10^{-1}	1×10^{6}	1×10^{1}
Tb-157	4×10^{1}	4×10^{1}	1×10^{7}	1×10^{4}
Tb-158	1×10^{0}	1×10^{0}	1×10^{6}	1×10^{1}
Tb-160	1×10^{0}	6×10^{-1}	1×10^{6}	1×10^{1}
Tb-161	3×10^{1}	7×10^{-1}	1×10^{6}	1×10^{3}
Technetium (43)				
Tc-95m (a)	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{1}
Tc-96	4×10^{-1}	4×10^{-1}	1×10^{6}	1×10^{1}
Tc-96m (a)	4×10^{-1}	4×10^{-1}	1×10^{7}	1×10^{3}
Tc-97	Unlimited	Unlimited	1×10^{8}	1×10^{3}
Tc-97m	4×10^{1}	1×10^{0}	1×10^{7}	1×10^{3}
Tc-98	8×10^{-1}	7×10^{-1}	1×10^{6}	1×10^{1}
Tc-99	4×10^{1}	9×10^{-1}	1×10^{7}	1×10^{4}
Tc-99m	1×10^{1}	4×10^{0}	1×10^{7}	1×10^{2}
Tellurium (52)				
Te-121	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{1}
Te-121m	5×10^{0}	3×10^{0}	1×10^{6}	1×10^{2}
Te-123m	8×10^{0}	1×10^{0}	1×10^{7}	1×10^{2}
Te-125m	2×10^{1}	9×10^{-1}	1×10^{7}	1×10^{3}
Te-127	2×10^{1}	7×10^{-1}	1×10^{6}	1×10^{3}
Te-127m (a)	2×10^{1}	5×10^{-1}	1×10^{7}	1×10^{3}
Te-129	7×10^{-1}	6×10^{-1}	1×10^{6}	1×10^{2}
Te-129m (a)	8×10^{-1}	4×10^{-1}	1×10^{6}	1×10^{3}
Te-131m (a)	7×10^{-1}	5×10^{-1}	1×10^{6}	1×10^{1}
Te-132 (a)	5×10^{-1}	4×10^{-1}	1×10^{7}	1×10^{2}
Thorium (90)				

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Th-227	1×10^{1}	5×10^{-3}	1×10^{4}	1×10^{1}
Th-228 (a)	5×10^{-1}	1×10^{-3}	1×10^{4} (b)	1×10^{0} (b)
Th-229	5×10^{0}	5×10^{-4}	1×10^{3} (b)	1×10^{0} (b)
Th-230	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{0}
Th-231	4×10^{1}	2×10^{-2}	1×10^{7}	1×10^{3}
Th-232	Unlimited	Unlimited	1×10^{4}	1×10^{1}
Th-234 (a)	3×10^{-1}	3×10^{-1}	1×10^{5} (b)	1×10^{3} (b)
Th(nat)	Unlimited	Unlimited	1×10^{3} (b)	1×10^{0} (b)
Titanium (22)				
Ti-44 (a)	5×10^{-1}	4×10^{-1}	1×10^{5}	1×10^{1}
Thallium (81)				
Tl-200	9×10^{-1}	9×10^{-1}	1×10^{6}	1×10^{1}
Tl-201	1×10^{1}	4×10^{0}	1×10^{6}	1×10^{2}
Tl-202	2×10^{0}	2×10^{0}	1×10^{6}	1×10^{2}
Tl-204	1×10^{1}	7×10^{-1}	1×10^{4}	1×10^{4}
Thulium (69)				
Tm-167	7×10^{0}	8×10^{-1}	1×10^{6}	1×10^{2}
Tm-170	3×10^{0}	6×10^{-1}	1×10^{6}	1×10^{3}
Tm-171	4×10^{1}	4×10^{1}	1×10^{8}	1×10^{4}
Uranium (92)				
U-230 (fast lung absorption) (a)(d)	4×10^{1}	1×10^{-1}	1×10^{5} (b)	1×10^{1} (b)
U-230 (medium lung absorption)(a)(e)	4×10^{1}	4×10^{-3}	1×10^{4}	1×10^{1}
U-230 (slow lung absorption) (a)(f)	3×10^{1}	3×10^{-3}	1×10^{4}	1×10^{1}
U-232 (fast lung absorption) (d)	4×10^{1}	1×10^{-2}	1×10^{3} (b)	1×10^{0} (b)
U-232 (medium lung absorption) (e)	4×10^{1}	7×10^{-3}	1×10^{4}	1×10^{1}
U-232 (slow lung absorption) (f)	1×10^{1}	1×10^{-3}	1×10^{4}	1×10^{1}
U-233 (fast lung absorption) (d)	4×10^{1}	9×10^{-2}	1×10^{4}	1×10^{1}
U-233 (medium lung absorption) (e)	4×10^{1}	2×10^{-2}	1×10^{5}	1×10^{2}
U-233 (slow lung absorption) (f)	4×10^{1}	6×10^{-3}	1×10^{5}	1×10^{1}
U-234 (fast lung absorption) (d)	4×10^{1}	9×10^{-2}	1×10^{4}	1×10^{1}
U-234 (medium lung absorption) (e)	4×10^{1}	2×10^{-2}	1×10^{5}	1×10^{2}
U-234 (slow lung absorption) (f)	4×10^{1}	6×10^{-3}	1×10^{5}	1×10^{1}
U-235 (all lung absorption types) (a),(d),(e),(f)	Unlimited	Unlimited	1×10^{4} (b)	1×10^{1} (b)
U-236 (fast lung absorption) (d)	Unlimited	Unlimited	1×10^{4}	1×10^{1}
U-236 (medium lung absorption) (e)	4×10^{1}	2×10^{-2}	1×10^{5}	1×10^{2}
U-236 (slow lung absorption) (f)	4×10^{1}	6×10^{-3}	1×10^{4}	1×10^{1}
U-238 (all lung absorption types) (d),(e),(f)	Unlimited	Unlimited	1×10^{4} (b)	1×10^{1} (b)

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*	*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
U (nat)	Unlimited	Unlimited	1×10^3 (b)	1×10^0 (b)
U (enriched to 20% or less) (g)	Unlimited	Unlimited	1×10^3	1×10^0
U (dep)	Unlimited	Unlimited	1×10^3	1×10^0
Vanadium (23)				
V-48	4×10^{-1}	4×10^{-1}	1×10^5	1×10^1
V-49	4×10^1	4×10^1	1×10^7	1×10^4
Tungsten (74)				
W-178 (a)	9×10^0	5×10^0	1×10^6	1×10^1
W-181	3×10^1	3×10^1	1×10^7	1×10^3
W-185	4×10^1	8×10^{-1}	1×10^7	1×10^4
W-187	2×10^0	6×10^{-1}	1×10^6	1×10^2
W-188 (a)	4×10^{-1}	3×10^{-1}	1×10^5	1×10^2
Xenon (54)				
Xe-122 (a)	4×10^{-1}	4×10^{-1}	1×10^9	1×10^2
Xe-123	2×10^0	7×10^{-1}	1×10^9	1×10^2
Xe-127	4×10^0	2×10^0	1×10^5	1×10^3
Xe-131m	4×10^1	4×10^1	1×10^4	1×10^4
Xe-133	2×10^1	1×10^1	1×10^4	1×10^3
Xe-135	3×10^0	2×10^0	1×10^{10}	1×10^3
Yttrium (39)				
Y-87 (a)	1×10^0	1×10^0	1×10^6	1×10^1
Y-88	4×10^{-1}	4×10^{-1}	1×10^6	1×10^1
Y-90	3×10^{-1}	3×10^{-1}	1×10^5	1×10^3
Y-91	6×10^{-1}	6×10^{-1}	1×10^6	1×10^3
Y-91m	2×10^0	2×10^0	1×10^6	1×10^2
Y-92	2×10^{-1}	2×10^{-1}	1×10^5	1×10^2
Y-93	3×10^{-1}	3×10^{-1}	1×10^5	1×10^2
Ytterbium (70)				
Yb-169	4×10^0	1×10^0	1×10^7	1×10^2
Yb-175	3×10^1	9×10^{-1}	1×10^7	1×10^3
Zinc (30)				
Zn-65	2×10^0	2×10^0	1×10^6	1×10^1
Zn-69	3×10^0	6×10^{-1}	1×10^6	1×10^4
Zn-69m (a)	3×10^0	6×10^{-1}	1×10^6	1×10^2
Zirconium (40)				
Zr-88	3×10^0	3×10^0	1×10^6	1×10^2
Zr-93	Unlimited	Unlimited	1×10^7 (b)	1×10^3 (b)

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*		*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Zr-95 (a)	2×10^{0}	8×10^{-1}		1×10^{6}	1×10^{1}
Zr-97 (a)	4×10^{-1}	4×10^{-1}		1×10^{5} (b)	1×10^{1} (b)

(a) A_1 and/or A_2 values for these parent radionuclides include contributions from their progeny with half-lives less than 10 days, as listed in the following:

Mg-28	Al-28
Ar-42	K-42
Ca-47	Sc-47
Ti-44	Sc-44
Fe-52	Mn-52m
Fe-60	Co-60m
Zn-69m	Zn-69
Ge-68	Ga-68
Rb-83	Kr-83m
Sr-82	Rb-82
Sr-90	Y-90
Sr-91	Y-91m
Sr-92	Y-92
Y-87	Sr-87m
Zr-95	Nb-95m
Zr-97	Nb-97m, Nb-97
Mo-99	Tc-99m
Tc-95m	Tc-95
Tc-96m	Tc-96
Ru-103	Rh-103m
Ru-106	Rh-106
Pd-103	Rh-103m
Ag-108m	Ag-108
Ag-110m	Ag-110
Cd-115	In-115m
In-114m	In-114
Sn-113	In-113m
Sn-121m	Sn-121
Sn-126	Sb-126m
Te-118	Sb-118
Te-127m	Te-127
Te-129m	Te-129
Te-131m	Te-131
Te-132	I-132
I-135	Xe-135m
Xe-122	I-122
Cs-137	Ba-137
Ba-131	Cs-131
Ba-140	La-140
Ce-144	Pr-144m, Pr-144
Pm-148m	Pm-148
Gd-146	Eu-146
Dy-166	Ho-166
Hf-172	Lu-172
W-178	Ta-178
W-188	Re-188
Re-189	Os-189m
Os-194	Ir-194
Ir-189	Os-189m
Pt-188	Ir-188
Hg-194	Au-194
Hg-195m	Hg-195
Pb-210	Bi-210
Pb-212	Bi-212, Tl-208, Po-212
Bi-210m	Tl-206
Bi-212	Tl-208, Po-212
At-211	Po-211
Rn-222	Po-218, Pb-214, At-218, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Po-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212

Radionuclide (atomic number)	*Special form A_1 (TBq)*	*Other form A_2 (TBq)*		*Activity limit for an exempt consignment (Bq)*	*Activity concentration limit for exempt material (Bq/g)*
Ra-225	Ac-225, Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209				
Ra-226	Rn-222, Po-218, Pb-214, At-218, Bi-214, Po-214				
Ra-228	Ac-228				
Ac-225	Fr-221, At-217, Bi-213, Tl-209, Po-213, Pb-209				
Ac-227	Fr-223				
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208, Po-212				
Th-234	Pa-234m, Pa-234				
Pa-230	Ac-226, Th-226, Fr-222, Ra-222, Rn-218, Po-214				
U-230	Th-226, Ra-222, Rn-218, Po-214				
U-235	Th-231				
Pu-241	U-237				
Pu-244	U-240, Np-240m				
Am-242m	Am-242, Np-238				
Am-243	Np-239				
Cm-247	Pu-243				
Bk-249	Am-245				
Cf-253	Cm-249				
(b) Parent nuclides and their progeny included in secular equilibrium are listed in the following (the activity to be taken into account is that of the parent nuclide only):					
Sr-90	Y-90				
Zr-93	Nb-93m				
Zr-97	Nb-97				
Ru-106	Rh-106				
Ag-108m	Ag-108				
Cs-137	Ba-137m				
Ce-144	Pr-144				
Ba-140	La-140				
Bi-212	Tl-208 (0.36), Po-212 (0.64)				
Pb-210	Bi-210, Po-210				
Pb-212	Bi-212, Tl-208 (0.36), Po-212 (0.64)				
Rn-222	Po-218, Pb-214, Bi-214, Po-214				
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207				
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)				
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210				
Ra-228	Ac-228				
Th-228	Ra-224, Rn-220, Po-216, Pb212, Bi-212, Tl208 (0.36), Po-212 (0.64)				
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209				
Th-nat[1]	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)				
Th-234	Pa-234m				
U-230	Th-226, Ra-222, Rn-218, Po-214				
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0.36), Po-212 (0.64)				
U-235	Th-231				
U-238	Th-234, Pa-234m				
U-nat[1]	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210				
Np-237	Pa-233				
Am-242m	Am-242				
Am-243	Np-239				
(c) The quantity may be determined from a measurement of the rate of decay or a measurement of the dose rate at a prescribed distance from the source.					
(d) These values apply only to compounds of uranium that take the chemical form of UF_6, UO_2F_2 and $UO_2(NO_3)_2$ in both normal and accident conditions of transport.					
(e) These values apply only to compounds of uranium that take the chemical form of UO_3, UF_4, UCl_4 and hexavalent compounds in both normal and accident conditions of transport.					
(f) These values apply to all compounds of uranium other than those specified in (d) and (e) above.					
(g) These values apply to unirradiated uranium only.					(h)
NOTE:					
1. In the case of Th-natural, the parent nuclide is Th-232, in the case of U-natural the parent nuclide is U-238.					

Table 2-13. Basic radionuclide values for unknown radionuclides or mixtures

Radioactive contents	A_1 (Tbq)	A_2 (Tbq)	*Activity concentration limit for exempt material* (Bq/g)	*Activity limit for an exempt consignment* (Bq)
Alpha-emitting nuclides but no neutron emitters are known to be present	0.2	9×10^{-5}	1×10^{-1}	1×10^{3}
Only beta- or gamma-emitting nuclides are known to be present	0.1	0.02	1×10^{1}	1×10^{4}
Neutron-emitting nuclides are known to be present or no relevant data are available	0.001	9×10^{-5}	1×10^{-1}	1×10^{3}

7.2.3 Determination of other material characteristics

7.2.3.1 *Low specific activity (LSA) material*

7.2.3.1.1 (Reserved)

7.2.3.1.2 LSA material must be in one of three groups:

a) LSA-I

i) uranium and thorium ores and concentrates of such ores, and other ores containing naturally occurring radionuclides;

ii) other radioactive material in which the activity is distributed throughout and the estimated average specific activity does not exceed 30 times the values for activity concentration specified in 7.2.2.1 to 7.2.2.6. Fissile material may be included only if excepted under 7.2.3.5.

iii) natural uranium, depleted uranium, natural thorium, or their compounds or mixtures, that are unirradiated and in solid or liquid form;

iv) radioactive material for which the A_2 value is unlimited. Fissile material may be included only if excepted under 7.2.3.5; or

b) LSA-II

i) water with tritium concentration up to 0.8 TBq/L;

ii) other material in which the activity is distributed throughout and the estimated average specific activity does not exceed 10^{-4} A_2/g for solids and gases, and 10^{-5} A_2/g for liquids.

c) LSA-III – solids (such as consolidated wastes, activated materials), excluding powders, in which:

i) the radioactive material is distributed throughout a solid or a collection of solid objects, or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen and ceramic); and

ii) the estimated average specific activity of the solid, excluding any shielding material,

does not exceed 2×10^{-3} A_2/g.

7.2.3.2 *Surface contaminated object (SCO)*

7.2.3.2.1 SCO is classified in one of three groups:

a) SCO-I: A solid object on which:

i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 0.4 Bq/cm^2 for all other alpha emitters;

ii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm2 (or the area of the surface if less than 300 cm2) does not exceed 4 × 104 Bq/cm2 for beta and gamma emitters and low toxicity alpha emitters, or 4 × 103 Bq/cm2 for all other alpha emitters

iii) the fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 4×10^4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 4×10^3 Bq/cm^2 for all other alpha emitters; or

b) SCO-II: A solid object on which either the fixed or non-fixed contamination Swopped on the surface exceeds the applicable limits specified for SCO-I in a) above and on which:

i) the non-fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 400 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 40 Bq/cm^2 for all other alpha emitters;

ii) the fixed contamination on the accessible surface, averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm^2 for all other alpha emitters; or

iii) the non-fixed contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 8×10^5 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters, or 8×10^4 Bq/cm^2 for all other alpha emitters;

c) SCO-III: A large solid object which, because of its size, cannot be transported in a type of package described in these Instructions.

Note.— SCO-III material is forbidden for transport by air.

7.2.3.3 *Special form radioactive material*

7.2.3.3.1 Special form radioactive material must have at least one dimension not less than 5 mm. When a sealed capsule constitutes SEGMENT of the special form radioactive material, the capsule must be so manufactured that it can be opened only by destroying it. The design for special form radioactive material requires unilateral approval.

7.2.3.3.2 Special form radioactive material must be of such a nature or must be so

designed that if it is subjected to the tests specified in 7.2.3.3.4 to 7.2.3.3.8, it must meet the following requirements:

a) it would not break or shatter under the impact, percussion and bending tests specified in 7.2.3.3.5 a), b), c) or 7.2.3.3.6 a), as applicable; and
b) the activity in the water from the leaching tests specified in 7.2.3.3.7 and 7.2.3.3.8 would not exceed 2 kBq; or alternatively for sealed sources, the leakage rate for the volumetric leakage assessment test specified in ISO 9978:1992 “Radiation Protection – Sealed Radioactive Sources – Leakage Test Methods”, would not exceed the applicable acceptance threshold acceptable to the competent authority

c) it would not melt or disperse in the applicable heat test specified in 7.2.3.3.5 d) or 7.2.3.3.6 b), as applicable; and

7.2.3.3.3 Demonstration of compliance with the performance standards in 7.2.3.3.2 must be in accordance with 6;7.11.1 and 6;7.11.2.

7.2.3.3.4 Specimens that comprise or simulate special form radioactive material must be subjected to the impact test, the percussion test, the bending test, and the heat test specified in 7.2.3.3.5 or alternative tests as authorized in 7.2.3.3.6. A different specimen may be used for each of the tests. Following each test, a leaching assessment or volumetric leakage test must be performed on the specimen by a method no less sensitive than the methods given in 7.2.3.3.7 for indispersible solid material or 7.2.3.3.8 for encapsulated material.

7.2.3.3.5 The relevant test methods are:

a) Impact test: The specimen must drop onto the target from a height of 9 m. The target must be as defined in 6;7.13;

b) Percussion test: The specimen must be placed on a sheet of lead which is supported by a smooth, solid surface and struck by the flat face of a mild steel bar so as to cause an impact equivalent to that resulting from a free drop of 1.4 kg from a height of 1 m. The lower SEGMENT of the bar must be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm. The lead, of hardness number 3.5 to 4.5 on the Vickers scale and not more than 25 mm thick, must cover an area greater than that covered by the specimen. A fresh surface of lead must be used for each impact. The bar must strike the specimen so as to cause maximum damage.

c) Bending test: The test must apply only to long, slender sources with both a minimum length of 10 cm and a length to minimum width ratio of not less than 10. The specimen must be rigidly clamped in a horizontal position so that one-half of its length protrudes from the face of the clamp. The orientation of the specimen must be such that the specimen will suffer maximum damage when its free end is struck by the flat face of a steel bar. The bar must strike the specimen so as to cause an impact equivalent to that resulting from a free vertical drop of 1.4 kg from a height of 1 m. The lower SEGMENT of the bar must be 25 mm in diameter with the edges rounded off to a radius of (3.0 ± 0.3) mm.

d) Heat test: The specimen must be heated in air to a temperature of 800°C and held at that temperature for a period of 10 minutes and must then be allowed to cool.

7.2.3.3.6 Specimens that comprise or simulate radioactive material enclosed in a sealed capsule may be excepted from:

a) the tests prescribed in 7.2.3.3.5 a) and b) provided that the specimens are alternatively subjected to the impact test prescribed in ISO 2919:2012: “Radiation Protection – Sealed Radioactive Sources – General requirements and classification”:

   i) the Class 4 impact test if the mass of the special form radioactive material is less than 200 g; or

   ii) the Class 5 impact test if the mass of the special form radioactive material is 200 g or more but less than 500 g; and

b) the test prescribed in 7.2.3.3.5 d) provided the specimens are alternatively subjected to the Class 6 temperature test specified in ISO 2919:2012 “Radiation protection – Sealed radioactive sources – General requirements and classification”.

7.2.3.3.7 For specimens which comprise or simulate indispersible solid material, a leaching assessment must be performed as follows:

a) The specimen must be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test must be sufficient to ensure that at the end of the 7-day test period, the free volume of the unabsorbed and unreacted water remaining must be at least 10 per cent of the volume of the solid test sample itself. The water must have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20°C;

b) The water and the specimen must then be heated to a temperature of (50 ± 5)°C and maintained at this temperature for 4 hours;

c) The activity of the water must then be determined.

d) The activity of the water must then be determined;

e) The specimen must then be kept for at least 7 days in still air at not less than 30°C and relative humidity not less than 90 per cent;

f) The specimen must then be immersed in water of the same specification as in a) above and the water and the specimen heated to (50 ± 5)°C and maintained at this temperature for 4 hours;

7.2.3.3.8 For specimens which comprise or simulate radioactive material enclosed in a sealed capsule, either a leaching assessment or a volumetric leakage assessment must be performed as follows:

a) The leaching assessment must consist of the following steps:

i) the specimen must be immersed in water at ambient temperature. The water must have an initial pH of 6-8 with a maximum conductivity of 1 mS/m at 20°C;

ii) the water and specimen must then be heated to a temperature of (50 ± 5)°C and maintained at this temperature for 4 hours;

iii) the activity of the water must then be determined;

iv) the specimen must then be kept for at least 7 days in still air at not less than 30°C and relative humidity of not less than 90 per cent;

v) the process in i), ii) and iii) must be repeated;

b) The alternative volumetric leakage assessment must comprise any of the tests prescribed in ISO 9978:1992 “Radiation protection – Sealed radioactive sources – Leakage test methods”, provided that they are acceptable to the competent authority.

7.2.3.4 *Low dispersible radioactive material*

7.2.3.4.1 The design for low dispersible radioactive material requires multilateral approval. Low dispersible radioactive material must be such that the total amount of this radioactive material in a package, considering the provisions of 6;7.7.14, must meet the following requirements:

a) The dose rate at 3 m from the unshielded radioactive material does not exceed 10 mSv/h;

b) If subjected to the tests specified in 6;7.19.3 and 6;7.19.4, the airborne release in gaseous and particulate forms of up to 100 μm aerodynamic equivalent diameter would not exceed 100 A_2. A separate specimen may be used for each test; and

c) If subjected to the test specified in 7.2.3.4.3, the activity in the water would not exceed 100 A_2. In the application of this test, the damaging effects of the tests specified in b) above must be considered.

7.2.3.4.2 Low dispersible material must be tested as follows:

A specimen that comprises or simulates low dispersible radioactive material must be subjected to the enhanced thermal test specified in 6;7.19.3 and the impact test specified in 6;7.19.4. A different specimen may be used for each of the tests. Following each test, the specimen must be subjected to the leach test specified in 7.2.3.4.3. After each test, it must be determined if the applicable requirements of 7.2.3.4.1 have been met.

7.2.3.4.3 A solid material sample representing the entire contents of the package must be immersed for 7 days in water at ambient temperature. The volume of water to be used in the test must be sufficient to ensure that at the end of the 7-day test period, the free volume of the unabsorbed and unreacted water remaining must be at least 10 per cent of the volume of the solid test sample itself. The water must have an initial pH of 6-8 and a maximum conductivity of 1 mS/m at 20°C. The total activity of the free volume of water must be measured following the 7-day immersion of the test sample.

7.2.3.4.4 Demonstration of compliance with the performance standards in 7.2.3.4.1, 7.2.3.4.2 and 7.2.3.4.3 must be in accordance with 6;7.11.1 and 6;7.11.2.

7.2.3.5 *Fissile material*

7.2.3.5.1 Fissile material and packages containing fissile material must be classified under the relevant entry as fissile in accordance with Table 2-11 unless excepted by one of the provisions of sub-paragraphs a) to f) below and transported subject to the requirements of 7;2.9.4.3. All provisions apply only to material in packages that meets the requirements of 6;7.6.2.

a) Uranium enriched in uranium-235 to a maximum of 1 per cent by mass, and with a total plutonium and uranium-233 content not exceeding 1 per cent of the mass of uranium-235, provided that the fissile nuclides are distributed essentially homogeneously throughout the material. In addition, if uranium-235 is present in metallic, oxide or carbide forms, it must not form a lattice arrangement;

b) Liquid solutions of uranyl nitrate enriched in uranium-235 to a maximum of 2 per cent by mass, with a total plutonium and uranium-233 content not exceeding 0.002 per cent of the mass of uranium, and with a minimum nitrogen to uranium atomic ratio (N/U) of 2;

c) Uranium with a maximum uranium enrichment of 5 per cent by mass uranium-235 provided:

   i) there is no more than 3.5 g of uranium-235 per package;
   ii) transport of the package is subject to the consignment limit provided in 7;2.9.4.3 c);
   iii) the total plutonium and uranium-233 content does not exceed 1 per cent of the mass of uranium-235 per package;

d) Fissile nuclides with a total mass not greater than 2 g per package provided the package is transported subject to the consignment limit provided in 7;2.9.4.3 d);

e) Fissile nuclides with a total mass not greater than 45 g subject to the requirements of 7;2.9.4.3 e);

f) A fissile material that meets the requirements of 7;2.9.4.3 b), 7.2.3.6 and 5;1.2.2.1.

7.2.3.6 Fissile material excepted from classification as fissile under 7.2.3.5.1 f) must be subcritical without the need for accumulation control under the following conditions:

a) the conditions of 6;7.10.1 a);

b) the conditions consistent with the assessment provisions stated in 6;7.10.12 b) and 6;7.10.13 b) for packages; and

c) the conditions specified in 6;7.10.11 a).

7.2.4 Classification of packages

7.2.4.1 The quantity of radioactive material in a package must not exceed the relevant limits for the package type as specified below.

7.2.4.1.1 Classification as excepted packages

7.2.4.1.1.1 A package may be classified as excepted packages if it meets one of the following conditions:

a) it is an empty packaging having contained radioactive material;

b) it contains instruments or articles not exceeding the activity limits specified in columns 2 and 3 of Table 2-14;

c) it contains less than 0.1 kg of uranium hexafluoride not exceeding the activity limits specified in column 4 of Table 2-14

d) it contains articles manufactured of natural uranium, depleted uranium or natural thorium;

e) it contains radioactive material not exceeding the activity limits specified in column 4 of Table 2-14; or

f) . 7.2.4.1.1.2 The dose rate at any point on the external surface of an excepted package must not exceed 5 μSv/h.

7.2.4.1.1.3 Radioactive material which is enclosed in or is included as a component SEGMENT of an instrument or other manufactured article may be classified under UN 2911 – **Radioactive material, excepted package – instruments** or **articles** provided that:

a) the dose rate at 10 cm from any point on the external surface of any unpackaged instrument or article is not greater than 0.1 mSv/h; and

b) each instrument or article bears the mark “RADIOACTIVE” on its external surface except for the following:

i) radioluminescent time-pieces or devices;

ii) consumer products that either have received regulatory approval in accordance with 1;6.1.4 c) or do not individually exceed the activity limit for an exempt consignment in Table 2-12 (column 5), provided such products are transported in a package that bears the mark “RADIOACTIVE” on an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; and

iii) other instruments or articles too small to bear the mark “RADIOACTIVE”, provided that they are transported in a package that bears the mark “RADIOACTIVE” on its internal surface in such a manner that a warning of the presence of radioactive material is

visible on opening the package;

c) the active material is completely enclosed by non-active components (a device performing the sole function of containing radioactive material must not be considered to be an instrument or manufactured article);

d) the limits specified in columns 2 and 3 of Table 2-14 are met for each individual item and each package, respectively;

e) *reserved*; and

f) if the package contains fissile material, one of the provisions of 7.2.3.5.1 a) to f) applies.

7.2.4.1.1.4 Radioactive material in forms other than as specified in 7.2.4.1.1.3 and with an activity not exceeding the limits specified in column 4 of Table 2-14 may be classified under UN 2910 – **Radioactive material, excepted package – limited quantity of material**, provided that:

a) the package retains its radioactive contents under routine conditions of transport;

b) the package bears the mark “RADIOACTIVE” on either:

i) an internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; or

ii) the outside of the package, where it is impractical to mark an internal surface; and

c) if the package contains fissile material, one of the provisions of 7.2.3.5.1 a) to f) applies.

7.2.4.1.1.5 Uranium hexafluoride not exceeding the limits specified in column 4 of Table 2-14 may be classified under UN 3507 – **Uranium hexafluoride, radioactive material, excepted package**, less than 0.1 kg per package, non-fissile or fissile-excepted provided that:

a) the mass of uranium hexafluoride in the package is less than 0.1 kg; and

b) the conditions of 7.2.4.5.2 and 7.2.4.1.1.4 a) and b) are met.

7.2.4.1.1.6 Articles manufactured of natural uranium, depleted uranium or natural thorium and articles in which the sole radioactive material is unirradiated natural uranium, unirradiated depleted uranium or unirradiated natural thorium may be classified under UN 2909, **Radioactive material, excepted package – articles manufactured from natural uranium** or **depleted uranium** or **natural thorium** provided that the outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or some other substantial material.

7.2.4.1.1.7 An empty packaging which had previously contained radioactive material may be classified under UN 2908 – **Radioactive material, excepted package – empty packaging** provided that:

a) it is in a well-maintained condition and securely closed;

b) the outer surface of any uranium or thorium in its structure is covered with an inactive sheath made of metal or some other substantial material;

c) the level of internal non-fixed contamination, when averaged over any 300 cm^2, does not exceed:

i) 400 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; and

ii) 40 Bq/cm^2 for all other alpha emitters;

d) any labels which may have been displayed on it in conformity with 5;3.2.6 are no longer visible; and

e) if the packaging has contained fissile material, one of the provisions of 7.2.3.5.1 a) to f) or one of the provisions for exclusion for fissile nuclides, as described in the definition for fissile nuclides in 7.1.3, applies.

*Note. — The external dose rates at the surface of empty Type B(U) or Type B(M) packages may exceed 5 μSv/h due to the presence of depleted uranium in the shielding material. Such empty packages cannot be transported as UN 2908 – **Radioactive material, excepted package – empty packaging** as they do not meet the conditions specified in 7.2.4.1.1.2. These packages remain subject to all applicable SEGMENTs of these Technical Standardsand may be classified as:*

a) LSA-I as specified in 7.2.3.1.2 a) ii); or

b) Type B(U) package as specified in 7.2.4.6.2; or

c) Type B(M) package as specified in 7.2.4.6.3.

Table 2-14. Activity limits for excepted packages

	Instruments or article		*Materials*	
Physical state of contents	*Item limits**		*Package limits**	*Package limits**
Solids				
Special form	10^{-2} A_1		10^{-3} A_1	A_1
Other form	10^{-2} A_2		10^{-3} A_2	A_2
Liquids	10^{-3} A_2		10^{-4} A_2	10^{-1} A_2
Gases				
Tritium	2×10^{-2} A_2		2×10^{-2} A_2	2×10^{-1} A_2
Special form	10^{-3} A_1		10^{-3} A_1	10^{-2} A_1
Other forms	10^{-3} A_2		10^{-3} A_2	10^{-2} A_2
* For mixtures of radionuclides, see 7.2.2.4 to 7.2.2.6.				

7.2.4.2 *Classification as low specific activity (LSA) material*

7.2.4.2.1 Radioactive material may only be classified as LSA material if the definition of LSA in 7.1.3 and the conditions of 7.2.3.1, 4;9.2.1 and 7;2.9.2 are met.

7.2.4.3 *Classification as surface contaminated object (SCO)*

7.2.4.3.1 Radioactive material may be classified as SCO if the definition of SCO in 7.1.3 and the conditions of 7.2.3.2, 4;9.2.1 and 7;2.9.2 are met.

7.2.4.4 *Classification of Type A packages*

7.2.4.4.1 Packages containing radioactive material may be classified as Type A packages provided that the following conditions are met:

7.2.4.4.1.1 Type A packages must not contain activities greater than either of the following:

a) for special form radioactive material – A_1;

b) for all other radioactive material – A_2.

7.2.4.4.1.2 For mixtures of radionuclides whose identities and respective activities are known, the following condition must apply to the radioactive contents of a Type A package:

$$\sum_i \frac{B(i)}{A_1(i)} + \sum_j \frac{C(j)}{A_2(j)} \leq 1$$

where

B(i) is the activity of radionuclide i as special form radioactive material; A_1(i) is the A_1 value for radionuclide i;

C(j) is the activity of radionuclide j as other than special form radioactive material; A_2(j) is the A_2 value for radionuclide j.

7.2.4.5 *Classification of uranium hexafluoride*

7.2.4.5.1 Uranium hexafluoride must only be assigned to:

a) **UN 2977** – Radioactive material, uranium hexafluoride, fissile; or

b) **UN 2978** – **Radioactive material, uranium hexafluoride**, non-fissile or fissile excepted; or

c) **UN 3507** – **Uranium hexafluoride, radioactive material, excepted package**, less than 0.1 kg per package, non-fissile or fissile-excepted.

7.2.4.5.2 The contents of a package containing uranium hexafluoride must comply with the following requirements:

a) for UN Nos. 2977 and 2978, the mass of uranium hexafluoride must not be different from that allowed for the package design, and for UN 3507, the mass of uranium hexafluoride must be less than 0.1 kg;

b) the mass of uranium hexafluoride must not be greater than a value that would lead to an ullage smaller than 5 per cent at the maximum temperature of the package as specified for the plant systems where the package will be used; and

c) the uranium hexafluoride must be in solid form and the internal pressure must not be above atmospheric pressure when presented for transport.

7.2.4.6 *Classification as Type B(U), Type B(M) or Type C packages*

7.2.4.6.1 Packages not otherwise classified in 7.2.4 (7.2.4.1.1 to 7.2.4.5) must be classified in accordance with the competent authority certificate of approval for the package issued by the country of origin of design.

7.2.4.6.2 The contents of a Type B(U), Type B(M) or Type C package must be as specified in the certificate of approval.

7.2.5 Special arrangements

Radioactive material must be classified as transported under special arrangement when it is intended to be transported in accordance with 1;6.4.

Section 8

CLASS 8 – CORROSIVE SUBSTANCES

8.1 DEFINITION AND GENERAL PROVISIONS

8.1.1 Corrosive substances are substances which, by chemical action, will cause irreversible damage to the skin or, in the case of leakage, will materially damage, or even destroy, other goods or the means of transport.

8.1.2 For substances and mixtures that are corrosive to skin, general classification provisions are provided in 8.2. Skin corrosion refers to the production of irreversible damage to the skin, namely, visible necrosis through the epidermis and into the dermis occurring after exposure to a substance or mixture.

8.1.3 Liquids and solids which may become liquid during transport, which are judged not to be skin corrosive, must still be considered for their potential to cause corrosion to certain metal surfaces in accordance with the criteria in 8.3.3 c) ii).

8.2 GENERAL CLASSIFICATION PROVISIONS

8.2.1 Substances and mixtures of Class 8 are divided among the three packing groups according to their degree of danger in transport as follows:

a) Packing Group I: **Very dangerous** substances and mixtures;

b) Packing Group II: Substances and mixtures presenting **medium danger;**

c) Packing Group III: Substances and mixtures presenting **minor danger.**

8.2.2 Allocation of substances listed in Table 3-1 to the packing groups in Class 8 has been made based on experience, considering such additional factors as inhalation risk (see 8.2.4) and reactivity with water, including the formation of hazardous decomposition products.

8.2.3 New substances and mixtures can be assigned to packing groups on the basis of the length of time of contact necessary to produce irreversible damage of intact skin tissue in accordance with the criteria in 8.3. Alternatively, for mixtures, the criteria in 8.4 can be used.

8.2.4 A substance or mixture meeting the criteria of Class 8 having an inhalation toxicity of dusts and mists (LC_{50}) in the range of Packing Group I, but toxicity through oral ingestion or dermal contact only in the range of Packing Group III or less, must be allocated to Class 8 (see Note under 6.2.2.4.1).

8.3 PACKING GROUP ASSIGNMENT FOR SUBSTANCES AND MIXTURES

8.3.1 Existing human and animal data, including information from single or repeated exposure, must be the first line of evaluation, as they give information directly relevant to effects on the skin.

8.3.2 In assigning the packing group in accordance with 8.2.3, account must be taken of human experience in instances of accidental exposure. In the absence of human experience, classification must be based on data obtained from experiments in accordance with:

- OECD Guideline for the Testing of Chemicals No. 404,
- *Acute Dermal Irritation/Corrosion*, 2015, No. 435,
- *In Vitro Membrane Barrier Test Method for Skin Corrosion*, 2015, No. 431,
- *In Vitro Skin Corrosion: Reconstructed Human Epidermis (RHE) Test Method,* 2016 or No. 430,
- *In Vitro Skin Corrosion: Transcutaneous Electrical Resistance (TER) Test Method,* 2015.

8.3.2.1 A substance or mixture which is determined not to be corrosive in accordance with OECD Guideline for the Testing of Chemicals No. 404, No. 435, No. 431 or No. 430 or non-classified in accordance with No. 439, *In Vitro Skin Irritation: Reconstructed Human Epidermis Test Method,* 2015 may be considered not to be corrosive to skin for the purposes of these Technical Standards without further testing. If the test results indicate that the substance or mixture is corrosive and not assigned

to Packing Group I, but the test method does not allow discrimination between Packing Groups II and III, it must be considered to be Packing Group II. If the test results indicate that the substance or mixture is corrosive, but the test method does not allow discrimination between packing groups, it must be assigned to Packing Group I if no other test results indicate a different packing group.

8.3.3 Packing groups are assigned to corrosive substances in accordance with the following criteria (see Table 2-15):

a) Packing Group I is assigned to substances that cause irreversible damage of intact skin tissue within an observation period of up to 60 minutes starting after the exposure time of 3 minutes or less.

b) Packing Group II is assigned to substances that cause irreversible damage of intact skin tissue within an observation period of up to 14 days starting after the exposure time of more than 3 minutes but not more than 60 minutes.

c) *Packing Group III* is assigned to substances that:

i) cause irreversible damage of intact skin tissue within an observation period of up to 14 days starting after the exposure time of more than 60 minutes but not more than 4 hours; or

ii) are judged not to cause irreversible damage of intact skin tissue but which exhibit a corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55°C when tested on both materials. For the purposes of

testing steel, type:

- S235JR+CR (1.0037 resp. St 37-2),
- S275J2G3+CR (1.0144 resp. St 44-3),
- ISO 3574, Unified Numbering System (UNS) G10200 or SAE 1020, and for testing aluminium, non-clad types 7075-T6 or AZ5GU-T6, must be used.
- An acceptable test is prescribed in the UN *Manual of Tests and Criteria*, SEGMENT III, Section 37.

Note. — Where an initial test on either steel or aluminium indicates the substance being tested is corrosive, the follow up test on the other metal is not required.

Table 2-15. Summary of criteria for assigning packing groups to corrosive substances

Packing group	*Exposure time*		*Effect*	*Observation period*
I	≤ 3 min		Irreversible damage of intact skin	≤ 60 min
II	> 3 min ≤ 1 h		Irreversible damage of intact skin	≤ 14 d
III	> 1 h ≤ 4 h		Irreversible damage of intact skin	≤ 14 d
III	–		Corrosion rate on either steel or aluminium surfaces exceeding 6.25 mm a year at a test temperature of 55ºC when tested on both materials	–

8.4 ALTERNATIVE PACKING GROUP ASSIGNMENT METHODS FOR MIXTURES: STEP-WISE APPROACH

8.4.1 General provisions

For mixtures, it is necessary to obtain or derive information that allows the criteria to be applied to the mixture for the purpose of classification and assignment of packing groups. The approach to classification and assignment of packing groups is tiered and is dependent upon the amount of information available for the mixture itself, for similar mixtures and/or for its ingredients. The flow chart of Figure 2-2 outlines the process to be followed.

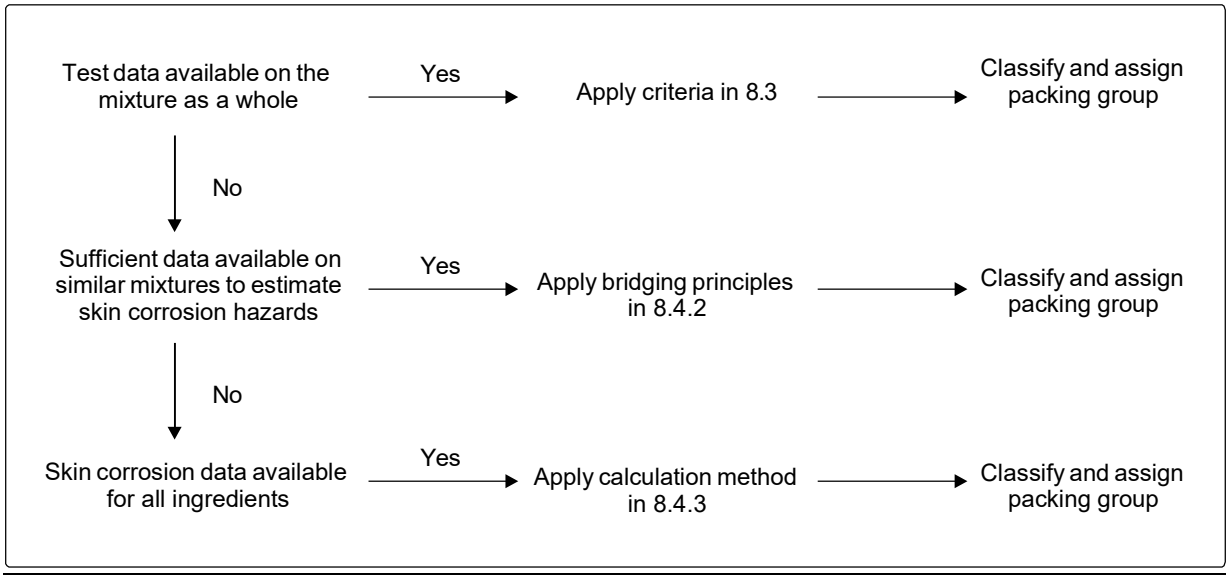

Figure 2-2. Step-wise approach to classify and assign packing group of corrosive mixtures

8.4.2 Bridging principles

Where a mixture has not been tested to determine its skin corrosion potential, but there are sufficient data on both the individual ingredients and similar tested mixtures to adequately classify and assign a packing group for the mixture, these data will be used in accordance with the following bridging principles. This ensures that the classification process uses the available data to the greatest extent possible in characterizing the hazards of the mixture.

a) **Dilution.** If a tested mixture is diluted with a diluent which does not meet the criteria for Class 8 and does not affect the packing group of other ingredients, then the new diluted mixture may be assigned to the same packing group as the original tested mixture.

Note. — In certain cases, diluting a mixture or substance may lead to an increase in the corrosive properties. If this is the case, this bridging principle cannot be used.

b) **Batching.** The skin corrosion potential of a tested production batch of a mixture can be assumed to be substantially equivalent to that of another untested production batch of the same commercial product when produced by or under the control of the same manufacturer, unless there is reason to believe there is significant variation such that the skin corrosion potential of the untested batch has changed. If the latter occurs, a new classification is necessary.

c) **Concentration of mixtures of Packing Group I**. If a tested mixture meeting the criteria for inclusion in Packing Group I is concentrated, the more concentrated untested mixture may be assigned to Packing Group I without additional testing.

d) **Interpolation within one packing group.** For three mixtures (A, B and C) with identical ingredients, where mixtures A and B have been tested and are in the same skin corrosion packing group, and where untested mixture C has the same Class 8 ingredients as mixtures A and B but has concentrations of Class 8 ingredients

intermediate to the concentrations in mixtures A and B, then mixture C is assumed to be in the same skin corrosion packing group as A and B.

e) *Substantially similar mixtures.* Given the following:

i) two mixtures: (A+B) and (C+B);
ii) data on skin corrosion for ingredients A and C are available and substantially equivalent, that is, they are in the same skin corrosion packing group and do not affect the skin corrosion potential of B;

iii) the concentration of ingredient B is the same in both mixtures;

iv) the concentration of ingredient A in mixture (A+B) equals the concentration of ingredient C in mixture (C+B);

if mixture (A+B) or (C+B) is already classified based on test data, then the other mixture may be assigned to the same packing group.

8.4.3 Calculation method based on the classification of the substances

8.4.3.1 Where a mixture has not been tested to determine its skin corrosion potential, nor is sufficient data available on similar mixtures, the corrosive properties of the substances in the mixture must be considered to classify and assign a packing group. Applying the calculation method is only allowed if there are no synergistic effects that make the mixture more corrosive than the sum of its substances. This restriction applies only if Packing Group II or III would be assigned to the mixture.

8.4.3.2 When using the calculation method, all Class 8 ingredients present at a concentration of ≥1 per cent must be taken into account, or <1 per cent if these ingredients are still relevant for classifying the mixture to be corrosive to skin.

8.4.3.3 To determine whether a mixture containing corrosive substances must be considered a corrosive mixture and to assign a packing group, the calculation method in the flow chart in Figure 2-3 must be applied.

8.4.3.4 When a specific concentration limit (SCL) is assigned to a substance following its entry in Table 3-1 or in a special provision, this limit must be used instead of the generic concentration limits (GCL). This appears where 1 per cent is used in the first step for the assessment of the Packing Group I substances, and where 5 per cent is used for the other steps respectively in Figure 2-3.

8.4.3.5 For this purpose, the summation formula for each step of the calculation method must be adapted. This means that, where applicable, the generic concentration limit must be substituted by the specific concentration limit assigned to the substance(s) (SCL_i), and the adapted formula is a weighted average of the different concentration limits assigned to the different substances in the mixture:

$$\frac{PGx_1}{GCL} + \frac{PGx_2}{SCL_2} + \ldots + \frac{PGx_i}{SCL_i} \geq 1$$

Where:

PGx_i = concentration of substance 1, 2 … i in the mixture, assigned to

Packing Group x (I, II or III) GCL = generic concentration limit

SCL_i = specific concentration limit assigned to substance i

The criterion for a packing group is fulfilled when the result of the calculation is ≥1. The generic concentration limits to be used for the evaluation in each step of the calculation method are those found in Figure 2-3.

Note. — Examples for the application of the above formula:

Example 1

A mixture contains one corrosive substance in a concentration of 5 per cent assigned to Packing Group I without a specific concentration limit:

Calculation for Packing Group I:

$$\frac{5}{5_{(GCL)}} = 1 \quad \square \text{ assign to Class 8, Packing Group I:}$$

Example 2

A mixture contains three substances corrosive to skin; two of them (A and B) have specific concentration limits; for the third one (C) the generic concentration limits apply. The rest of the mixture need not be taken into consideration:

Substance X in the mixture and its packing group assignment within Class 8	Concentration (conc) in the mixture	Specific concentration limit (SCL) for Packing Group I	Specific concentration limit (SCL) for Packing Group II	Specific concentration limit (SCL) for Packing Group III
A – assigned to Packing Group I	3%	30%	n/a	n/a
B – assigned to Packing Group I	2%	20%	10%	n/a
C – assigned to Packing Group III	10%	n/a	n/a	n/a

Calculation for Packing Group I:

$$\frac{3\ (conc\ A)}{30\ (SCL\ PGI)} + \frac{2\ (conc\ B)}{20\ (SCL\ PGI)} = 0.2 < 1$$

The criterion for Packing Group I is not fulfilled.

Calculation for Packing Group II:

$$\frac{3\ (conc\ A)}{5\ (GCL\ PG\ II)} + \frac{2\ (conc\ B)}{10\ (SCL\ PG\ II)} = 0.8 < 1$$

The criterion for Packing Group II is not fulfilled.

Calculation for Packing Group III:

$$\frac{3\ (conc\ A)}{5\ (GCL\ PGIII)} + \frac{2\ (conc\ B)}{5\ (GCL\ PG\ III)} + \frac{10\ (conc\ C)}{5\ (GCL\ PG\ III)} = 3 \geq 1$$

The criterion for Packing Group III is fulfilled, the mixture must be assigned to Class 8, Packing Group III.

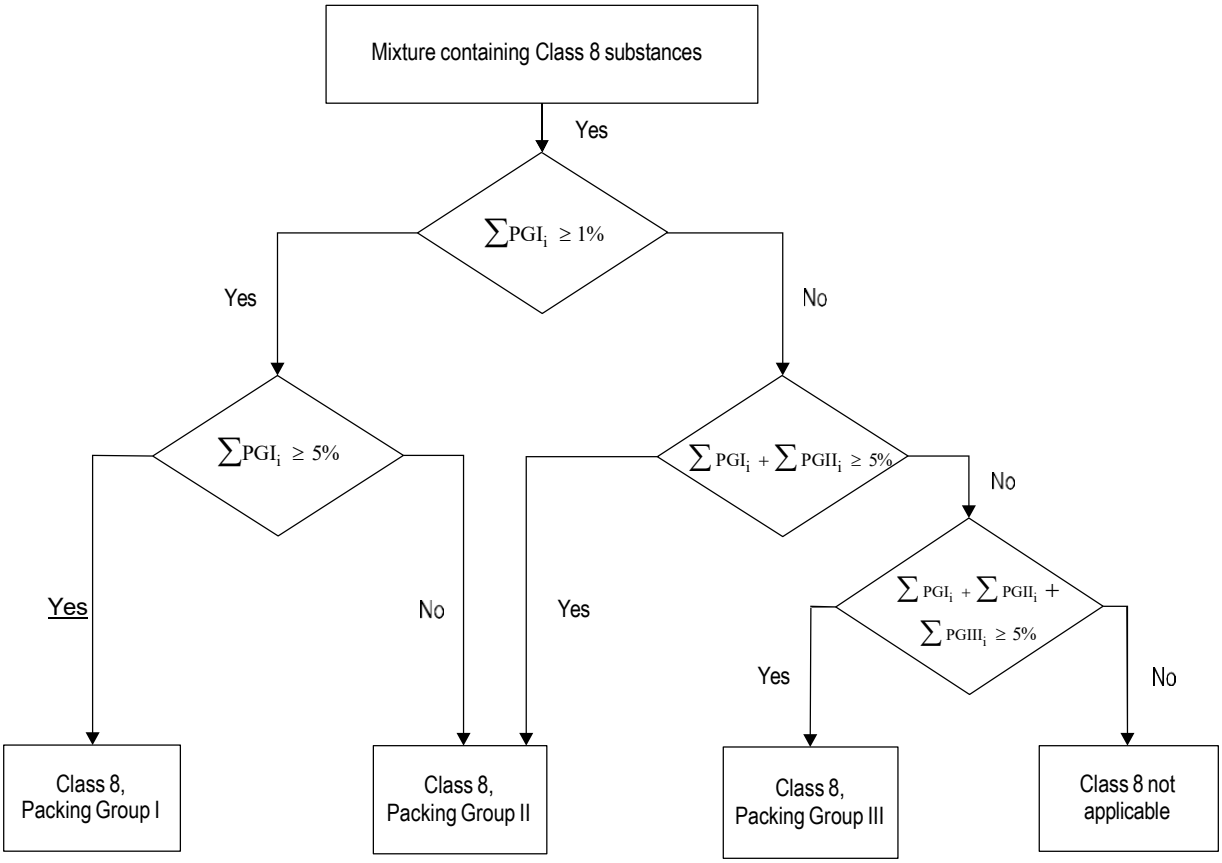

Figure 2-3. Calculation method

8.5 SUBSTANCES FORBIDDEN FOR TRANSPORT

Chemically unstable substances of Class 8 are forbidden for transport unless the necessary precautions have been taken to prevent the possibility of a dangerous decomposition or polymerization under normal conditions of transport. For the precautions necessary to prevent polymerization, see Special Provision A209. To this end, particular care must be taken to ensure that receptacles do not contain any substances liable to promote these reactions.

Section 9

CLASS 9 – MISCELLANEOUS DANGEROUS SUBSTANCES AND ARTICLES, INCLUDING ENVIRONMENTALLY HAZARDOUS SUBSTANCES

9.1 DEFINITION

9.1.1 *Class 9 substances and articles (miscellaneous dangerous substances and articles)* are substances and articles which, during air transport, present a danger not covered by other classes.

9.1.2 *Genetically modified micro-organisms (GMMOs) and genetically modified organisms (GMOs)* are micro-organisms and organisms in which genetic material has been purposely altered through genetic engineering in a way that does not occur naturally.

9.2 ASSIGNMENT TO CLASS 9

The substances and articles of Class 9 are subdivided as shown in Table 2-16.

Table 2-16. Substances and articles of Class 9

UN number	*Name*	*Notes*
Substances which, on inhalation as fine dust, may endanger health		
2212	**Asbestos, amphibole** (amosite, tremolite, actinolite, anthophyllite, crocidolite)	
2590	**Asbestos, chrysotile**	
Substances evolving flammable vapour		
2211	**Polymeric beads, expandable**, evolving flammable vapour	
3314	**Plastics moulding compound** in dough, sheet or extruded rope form evolving flammable vapour	
Lithium batteries		

3090	**Lithium metal batteries** (including lithium alloy batteries)	See 9.3
3091	**Lithium metal batteries contained in equipment** (including lithium alloy batteries)	
3091	**Lithium metal batteries packed with equipment** (including lithium alloy batteries)	
3480	**Lithium ion batteries** (including lithium ion polymer batteries)	
3481	**Lithium ion batteries contained in equipment** (including lithium ion polymer batteries)	
3481	**Lithium ion batteries packed with equipment** (including lithium ion polymer batteries)	
3536	**Lithium batteries installed in cargo transport unit**	

UN number	*Name*	*Notes*
Sodium ion batteries		
3551	**Sodium ion batteries** with organic electrolyte	See 9.4
3552	**Sodium ion batteries contained in equipment** with organic electrolyte	
3552	**Sodium ion batteries packed with equipment** with organic electrolyte	
Capacitors		
3499	**Capacitor, electric double layer** (with an energy storage capacity greater than 0.3 Wh)	
3508	**Capacitor, asymmetric** (with an energy storage capacity greater than 0.3 Wh)	
Life-saving appliances		
2990	**Life-saving appliances, self-inflating**	
3072	**Life-saving appliances, not self-inflating** containing dangerous goods as equipment	
3268	**Safety devices**, electrically initiated	
3559	**Fire suppressant dispersing devices**	
Substances and articles which, in the event of fire, may form dioxins		
2315	**Polychlorinated biphenyls, liquid**	Examples of articles are transformers, condensers and apparatus containing those substances.
3432	**Polychlorinated biphenyls, solid**	
3151	**Polyhalogenated biphenyls, liquid**	
3151	**Halogenated monomethyldiphenylmethanes, liquid**	
3151	**Polyhalogenated terphenyls, liquid**	
3152	**Polyhalogenated biphenyls, solid**	
3152	**Halogenated monomethyldiphenylmethanes, solid**	
3152	**Polyhalogenated terphenyls, solid**	
Substances transported or offered for transport at elevated temperatures		
3257	**Elevated temperature liquid, n.o.s.**, at or above 100°C and below its flash point (including molten metals, molten salts, etc.)	Elevated temperature substances (i.e. substances that are transported or offered for transport at temperatures equal to or exceeding 100°C in a liquid state or at temperatures equal to or exceeding 240°C in a solid state (these substances may only be carried under Segment 1;1.1)).
3258	**Elevated temperature solid, n.o.s.**, at or above 240°C	
Environmentally hazardous substances		
3077	**Environmentally hazardous substance, solid, n.o.s.**	Environmentally hazardous substances (aquatic environment) are those that meet the criteria in 2.9.3 of the UN Model Regulations or that meet criteria in international regulations or national regulations established by the appropriate national authority in the State of Origin, Transit or Destination of the consignment.
3082	**Environmentally hazardous substance, liquid, n.o.s.**	
		Substances or mixtures dangerous to the aquatic environment not otherwise classified under these Technical Standards must be assigned to Packing Group III and assigned to UN 3077 or UN 3082.

UN number	*Name*	*Notes*
Genetically modified micro-organisms (GMMOs) and genetically modified organisms (GMOs)		
3245	**Genetically modified micro-organisms**	GMMOs or GMOs which do not meet the definition of toxic substances (see 6.2) or infectious substances (see 6.3) must be assigned to UN 3245. GMMOs or GMOs are not subject to these Technical authorized for use by the appropriate national authorities of the States of Origin, Transit and Destination. Pharmaceutical products (such as vaccines) that are packed in a form ready to be administered, including those in clinical trials, and that contain GMMOs or GMOs are not subject to these Instructions. Genetically modified live animals must be transported under terms and conditions of the appropriate national authorities of the States of Origin and Destination.
3245	**Genetically modified organisms**	
Ammonium nitrate based fertilizers		
2071	**Ammonium nitrate based fertilizer**	Solid ammonium nitrate based fertilizers must be classified in accordance with the procedure as set out in the UN *Manual of Tests and Criteria*, SEGMENT III, Section 39.
Other substances or articles presenting a danger during transport, but not meeting the definitions of another class		
1841	**Acetaldehyde ammonia**	
1845	**Dry ice**	
1845	**Carbon dioxide, solid**	
1931	**Zinc dithionite**	
1931	**Zinc hydrosulphite**	
1941	**Dibromodifluoromethane**	
1990	**Benzaldehyde**	
2216	**Fish meal, stabilized**	
2216	**Fish scrap, stabilized**	

UN number	*Name*	*Notes*
2807	**Magnetized material**	Magnetized material is any material which, when packed for air transport, has a maximum magnetic field strength sufficient to cause a compass deflection of more than 2 degrees at a distance of 2.1 m from any point on the surface of the assembled package. The magnetic field strength at the compass producing a 2 degree deflection is taken to be 0.418 A/m (0.00525 Gauss). The magnetic field strength must be measured with a magnetic compass sensitive enough to read a 2 degree variation, preferably in 1 degree increments or finer, or using a Gauss meter having a sensitivity sufficient to measure magnetic fields greater than 0.0005 Gauss within a tolerance of plus or minus 5 per cent, or by an equivalent means. Compass measurements must be taken in an area free from magnetic interference other than the Earth's magnetic field. When using a compass, the material and the compass must be aligned in an east-west direction. Gauss meter measurements must be in accordance with the manufacturer's instructions. Measurements are taken while the packaged material is rotated through 360 degrees in its horizontal plane while maintaining a constant distance (2.1 m or 4.6 m as referred to in Packing Instruction 953) between the measuring device and any point on the outside surface of the package. Shielding may be used to reduce the package's magnetic strength. *Note.— Masses of ferro-magnetic metals such as automobiles, automobile parts, metal fencing, piping and metal construction material, even if not meeting the definition of magnetized material may affect aircraft compasses, as may packages or items which individually do not meet the definition of magnetized material but cumulatively may have a magnetic field strength of a magnetized material.*
2969	**Castor beans**	
2969	**Castor meal**	
2969	**Castor pomace**	
2969	**Castor flake**	
3166	**Vehicle, flammable gas powered**	
3166	**Vehicle, flammable liquid powered**	
3166	**Vehicle, fuel cell, flammable gas powered**	
3166	**Vehicle, fuel cell, flammable liquid powered**	
3171	**Battery-powered vehicle**	
3171	**Battery-powered equipment**	
3316	**Chemical kit**	
3316	**First aid kit**	
3334	**Aviation regulated liquid, n.o.s.**	Aviation regulated liquid is any material which has narcotic, noxious or other properties such that, in the event of spillage or leakage on an aircraft, extreme annoyance or discomfort could be caused to crew members so as to prevent the correct performance of assigned duties.

	UN number	*Name*	*Notes*
	3335	**Aviation regulated solid, n.o.s.**	Aviation regulated solid is any material which has narcotic, noxious or other properties such that, in the event of spillage or leakage on an aircraft, extreme annoyance or discomfort could be caused to crew members so as to prevent the correct performance of assigned duties.
	3359	**Fumigated cargo transport unit**	
	3363	**Dangerous goods in machinery**	
	3363	**Dangerous goods in apparatus**	
	3363	**Dangerous goods in articles**	
	3509	**Packagings, discarded, empty, uncleaned**	
	3530	**Engine, internal combustion**	
	3530	**Machinery, internal combustion**	
	3548	**Articles containing miscellaneous dangerous goods, n.o.s.**	
+	3556	**Vehicle, lithium ion battery powered**	
+	3557	**Vehicle, lithium metal battery powered**	
+	3558	**Vehicle, sodium ion battery powered**	

9.3 LITHIUM BATTERIES

Cells and batteries, cells and batteries contained in equipment or cells and batteries packed with equipment, containing lithium in any form must be assigned to UN Nos. 3090, 3091, 3480 or 3481, as appropriate. They may be transported under these entries provided:

a) each cell or battery is of the type proved to meet the requirements of each test of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;

Cell and battery types only meeting the requirements of the UN Manual of Tests and Criteria, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled.

Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the UN *Manual of Tests and Criteria*, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in these Instructions.

Note. — Batteries must be of a type proved to meet the testing requirements of the UN Manual of Tests and Criteria, Part III, subsection 38.3, irrespective of whether the cells of which they are composed are of a tested type.

b) Each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under conditions normally incident to transport;

c) Each cell and battery is equipped with an effective means of preventing external short circuits;

d) Each battery containing cells or a series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow (such as diodes, fuses, etc.);

e) cells and batteries are manufactured under a quality management programme that includes:

1) a description of the organizational structure and responsibilities of personnel with regard to design and product quality;

2) the relevant inspection and test, quality control, quality assurance, and process operation Technical Standards that will be used;

3) process controls that should include relevant activities to prevent and detect internal short circuit failure during manufacture of cells;

4) quality records, such as inspection reports, test data, calibration data and certificates. Test data must be kept and made available to the appropriate national authority upon request;

5) management reviews to ensure the effective operation of the quality management programme;

6) a process for control of documents and their revision;

7) a means for control of cells or batteries that are not conforming to the type tested in accordance with Part III, subsection 38.3 of the UN *Manual of Tests and Criteria*;

8) training programmes and qualification procedures for relevant personnel;

9) procedures to ensure that there is no damage to the final product;

Note. — In-house quality management programmes may be accepted. Third-party certification is not required, but the procedures listed in 1) to 9) above must be properly recorded and traceable. A copy of the quality management programme must be made available to the appropriate national authority upon request.

f) lithium batteries, containing both primary lithium metal cells and rechargeable lithium-ion cells, that are not designed to be externally charged (see Special Provision A213), meet the following conditions:

i) the rechargeable lithium ion cells can only be charged from the primary lithium metal cells;

ii) overcharge of the rechargeable lithium ion cells is precluded by design;

iii) the battery has been tested as a lithium primary battery;

iv) component cells of the battery are of a type proved to meet the respective testing requirements of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3; and

g) except for button cells installed in equipment (including circuit boards), manufacturers and subsequent distributors of cells or batteries manufactured after 30 June 2003 make available the test summary as specified in the UN Manual of Tests and Criteria, Segment III, subsection 38.3, paragraph 38.3.5.

Note. — The term "make available" means that manufacturers and subsequent distributors ensure that the test summary is accessible so that the shipper or other persons in the supply chain can confirm compliance.

9.4 SODIUM ION BATTERIES

Cells and batteries, cells and batteries contained in equipment or cells and batteries packed with equipment containing sodium ion, which are a rechargeable electrochemical system where the positive and negative electrode are both intercalation or insertion compounds, constructed with no metallic sodium (or sodium alloy) in either electrode and with an organic non-aqueous compound as electrolyte, must be assigned to UN Nos. 3551 or 3552, as appropriate.

Note. — Intercalated sodium exists in an ionic or quasi-atomic form in the lattice of the electrode material.

They may be transported under these entries provided:

a) Each cell or battery is of the type proved to meet the requirements of applicable tests of the UN *Manual of Tests and Criteria*, Part III, subsection 38.3;

Note. — Batteries must be of a type proved to meet the testing requirements of the UN Manual of Tests and Criteria*, Part III, subsection 38.3, irrespective of whether the cells of which they are composed are of a tested type.*

b) Each cell and battery incorporates a safety venting device or is designed to preclude a violent rupture under conditions normally encountered during transport;

c) Each cell and battery is equipped with an effective means of preventing external short circuits;

d) Each battery containing cells or a series of cells connected in parallel is equipped with effective means as necessary to prevent dangerous reverse current flow (such as diodes, fuses, etc.);

e) cells and batteries are manufactured under a quality management programme as prescribed under 9.3 e) 1) to 9);

f) manufacturers and subsequent distributors of cells or batteries make available the test summary as specified in the UN *Manual of Tests and Criteria*, Part III, subsection 38.3, paragraph 38.3.5.

Note.— The term "make available" means that manufacturers and subsequent distributors ensure that the test summary is accessible so that the shipper or other persons in the supply chain can confirm compliance.

SEGMENT 3

DANGEROUS GOODS LIST, SPECIAL PROVISIONS AND LIMITED AND EXCEPTED QUANTITIES

(1) GENERAL

1.1.1 The Dangerous Goods List (Table 3-1) in this Chapter lists the dangerous goods most carried but is not exhaustive. It is intended that the list cover, as far as practicable, all dangerous substances of commercial importance.

1.1.2 Where an article or substance is specifically listed by name in the Dangerous Goods List, it must be transported in accordance with the provisions in the List which are appropriate for that article or substance. A “generic” or “not otherwise specified” entry may be used to permit the transport of substances or articles which do not appear specifically by name in the Dangerous Goods List. Such a substance or article may be transported only after its dangerous properties have been determined. The substance or article must then be classified according to the class definitions and test criteria and the name in the Dangerous Goods List which most appropriately describes the substance must be used. The classification must be made by the appropriate national authority when so required or may otherwise be made by the shipper. Once the class of the substance or article has been established, all conditions for dispatch and transport, as provided in these Instructions, must be met. Any substance or article having or suspected of having explosive characteristics must first be considered for inclusion in Class 1.

1.1.3 The List also includes a number of specific articles and substances whose transport by air is forbidden (see Part 1, Section 2).

1.1.4 Where precautionary measures are laid down in the Dangerous Goods List in respect of a given substance or article (such as that it must be “stabilized” or “with x% water or phlegmatizer”) such substance or article may not normally be carried when these measures have not been taken, unless the item in question is listed elsewhere (such as Class 1) without any indication of, or with different, precautionary measures.

1.1.5 Where there is any doubt as to whether a non-listed article or substance is permitted for transport by air, or under what conditions, the shipper and/or operator must consult an appropriate specialized agency.

1.1.6 The proper shipping name is that portion of the entry most accurately describing the goods in the Dangerous Goods List, which is shown in boldface characters, plus any:

I. numbers,

II. Greek letters,

III. “sec”, “tert”, and

IV. the letters m, n, o, p, which form an integral part of the name). Portions of an entry appearing in lightface type need not be considered as part of the proper shipping name but may be used.

1.1.7 Proper shipping names may be used in the singular or plural as appropriate. In addition, when qualifying words are used as part of the proper shipping name, their sequence on documentation or package marks is optional. For instance, **“Dimethylamine aqueous solution”** may alternatively be shown as **“Aqueous solution of Dimethylamine”**. However, the entry in column 1 reflects the preferred sequence. Alternative spelling reflecting common usage around the world is acceptable for words such as **“caesium”** for **“cesium”**, **“sulfur”** for **“sulphur”**, **“aluminum”** for **“aluminium”**, etc. However, the spelling appearing in Table 3-1 is

preferred.

1.1.8 Many substances have an entry for both the liquid and solid state (see definitions for liquid and solid in 1;3.1.1) or for the solid and solution. These are allocated separate UN numbers.

1.1.9 Unless it is already included in bold letters in the name indicated in the Dangerous Goods List, the qualifying word **"molten"** must be added as part of the proper shipping name when a substance, which is a solid in accordance with the definition in Segment 1;3.1, is offered for transport in the molten state (such as **Alkylphenol, solid, n.o.s., molten**).

1.1.10 Except for self-reactive substances and organic peroxides and unless it is already included in boldface characters in the name indicated in column 1 of the Dangerous Goods List, the word "**stabilized**" must be added as part of the proper shipping name of a substance which without stabilization would be forbidden from transport in accordance with 1;2.1 due to it being liable to react dangerously under conditions normally encountered in transport (such as **"Toxic liquid, organic, n.o.s., stabilized"**).

1.1.11 Hydrates may be transported under the proper shipping name for the anhydrous substance.

2. Generic and "not otherwise specified" proper shipping names, indicated by the inclusion of an asterisk in column 1 of the Dangerous Goods List, must be supplemented with the technical or chemical group names unless a national law or international convention prohibits their disclosure if it is a controlled substance. For explosives of Class 1, the dangerous goods description may be supplemented by additional descriptive text to indicate commercial or military names. Technical and chemical group names must be entered in brackets immediately following the proper shipping name. An appropriate modifier, such as "contains" or "containing" or other qualifying words such as "mixture", "solution", etc. and the percentage of the technical constituent may be used. For example: "UN 1993 **Flammable liquid, n.o.s.** (contains xylene and benzene), 3, PG II".

3. The technical name must be a recognized chemical or biological name or other name currently used in scientific and technical handbooks, journals and texts. Trade names must not be used for this purpose. In the case of pesticides, only ISO common name(s), other name(s) in the World Health Organization (WHO) *Recommended Classification of Pesticides by Hazard and Guidelines to Classification,* or the name(s) of the active substance(s) may be used.

4. When a mixture of dangerous goods or articles containing dangerous goods are described by one of the "n.o.s." or "generic" entries where an asterisk is indicated in column 1 of the Dangerous Goods List, not more than the two constituents which most predominantly contribute to the hazard or hazards of the mixture or of the articles need to be shown, excluding controlled substances when their disclosure is prohibited by national law or international convention. If a package containing a mixture is labelled with any subsidiary hazard label, one of the two technical names as shown in parentheses must be the name of the constituent which compels the use of the subsidiary hazard label.

5. Examples illustrating the selection of the proper shipping name supplemented with the technical name of the dangerous goods for such n.o.s. entries are:

UN 3540 **Articles containing flammable liquids n.o.s.** (pyrrolidine)

UN 3394 **Organometallic substance, liquid, pyrophoric, water-reactive** (Trimethylgallium) UN 2902 **Pesticide, liquid, toxic, n.o.s.** (Drazoxolon).

6. A mixture or solution is not subject to these Instructions if the characteristics, properties, form or physical state of the mixture or solution are such that it does not meet the criteria, including human experience criteria, for inclusion in any class.

7. A mixture or solution meeting the classification criteria of these Instructions composed of a single predominant substance identified by name in Table 3-1 and one or more substances not subject to these Instructions and/or traces of one or more substances identified by name in Table 3-1 must be assigned the UN number and proper shipping name of the predominant substance named in Table 3-1, unless:

a) the mixture or solution is specifically identified by name in Table 3-1 in which case this name must be applied; or

b) the name and description of the substance named in Table 3-1 specifically indicates that it applies only to the pure substance; or

c) the hazard characteristics and properties of the mixture or solution necessitate emergency response measures that are different from those required for the substance identified by name in Table 3-1.

d) the hazard class or division, subsidiary hazard(s), physical state or packing group of the solution or mixture is different from that of the substance named in Table 3-1; orIf b), c) or d) is applicable, the mixture or solution must be treated as a substance not specifically listed by name in Table 3-1.

8. Qualifying words such as **"solution"** or **"mixture"**, as appropriate, must be added as part of the proper shipping name, such as **"Acetone solution"**. In addition, the concentration of the solution or mixture may also be indicated after the basic description of the mixture or solution, such as **"Acetone 75% solution"**.

9. A mixture or solution meeting the classification criteria of these Instructions that is not identified by name in Table 3-1 and that is composed of two or more dangerous goods must be assigned to an entry that has the proper shipping name, description, hazard class or division, subsidiary hazard(s) and packing group that most precisely describe the solution or mixture.

Segment 3 Section 2

ARRANGEMENT OF THE DANGEROUS GOODS LIST

(1) The Dangerous Goods List (Table 3-1) is divided into 13 columns as follows:

Column 1 " Name" – this column contains the alphabetically arranged list of dangerous goods, identified by their proper shipping names in boldface characters (see 1.2). Also included, in lightface type, are:

a) other names by which certain articles and substances may be known; in such cases a cross reference to the proper shipping name is given;

b) names of articles and substances which are forbidden for carriage by air under any circumstances; and

c) names of articles and substances which are subject to additional considerations under special provisions. An explanation of some of the terms used appears in Attachment 2.

Entries in this column have been arranged in alphabetical order; where names comprise more than one word, they have been alphabetized as if they were a single word. In deciding the correct order, numbers and the terms n.o.s., alpha-, beta-, meta-, omega-, sec-, tert-, a-, b-, m-, N-, n-, O-, o- and p- have been ignored. Similarly, the word "see" and any words following it have been ignored.

Unless otherwise indicated, for an entry in the dangerous goods list, the word "solution" in a proper shipping name means one or more named dangerous goods dissolved in a liquid that is not otherwise subject to these Instructions.

Column 2 "UN No." – this column contains the serial number assigned to the article or substance under the United Nations classification system. Some entries in the list have not been assigned such a number and for these, a temporary identification number (ID) in the 8000 series has been allocated and is indicated where appropriate. Numbers in the 8000 series must be identified with the "ID" prefix instead of the "UN" prefix used when identifying all other numbers for marking and documentation in these Instructions. When the word "Forbidden" appears across this column and column 3, it means that the dangerous goods covered by that particular entry meet the description of dangerous goods forbidden on aircraft under any circumstances, as provided in 1;2.1. It must be noted, however, that all dangerous goods meeting this description have not been included in the Dangerous Goods List.

Column 3 " Class or division" – this column contains the class or division and, in the case of Class 1, the compatibility group assigned to the article or substance according to the classification system described in Part 2; Introductory Chapter.

Column 4 " Subsidiary hazard" – this column contains the class or division number of any important subsidiary hazards which have been identified by applying the classification found in Part 2; Chapters 1 to 9. Requirements for the labelling of dangerous goods which have subsidiary hazards are given in Segment 5;3.2.

Column 5 " Labels" – this column specifies the class hazard label followed by the subsidiary hazard label(s) (after the symbol "&") to be applied to each outside packaging and overpack. Subsidiary hazard labels are not shown for all n.o.s. or generic articles and substances which possess more than one hazard. When such an article or substance has more than one hazard and no subsidiary hazard label is indicated in column 5 of Table 3-1, subsidiary hazard labels must be applied in accordance with 5;3. For magnetized material the required handling label is also shown. In the instances where no label is required the word "None" will appear.

Column 6 " State variations" – this column contains references to entries in Attachment 3, which shows State variations from these Instructions (these appear under the designator and name of the State).

Column 7 "Special provisions" – this column contains a number referring to the appropriate entries in Table 3-2. Special provisions apply to all the packing groups

permitted for a particular substance or article unless the wording makes it otherwise apparent.

≠ **Column 8 " UN packing group"** – this column contains the UN packing group number (that is, I, II or III) assigned to the substance. If more than one packing group is indicated for the entry, the packing group of the substance or formulation to be transported should be determined, based on its properties, through application of the hazard grouping criteria as provided in Part 2.

Column 9 " Excepted quantities" – this column provides an alphanumeric code described in 5.1.2 which indicates the maximum quantity per inner and outer packaging for transporting dangerous goods as excepted quantities in accordance with Part 3, Chapter 5.

Column 10 "Passenger and cargo aircraft – Packing instruction" – this column refers to the relevant packing instructions listed in Segment 4 for transport of the article or substance on a passenger aircraft. For some entries an alternative packing instruction is shown prefixed with the letter "Y". Such packing instructions are for limited quantities of dangerous goods.

Column 11 "Passenger and cargo aircraft – Maximum net quantity per package" – this column shows the maximum net quantity (mass or volume) of the article or substance allowed in each package for transport on a passenger aircraft. Where a maximum net quantity appears beside a packing instruction prefixed by the letter "Y", this indicates it is the maximum net quantity permitted in a packaging containing limited quantities of dangerous goods unless indicated by a letter "G" where the mass quoted is the total mass of the package. The maximum quantity per package may be further limited by the type of packaging used. The maximum net quantities indicated may be exceeded only if specified in these Instructions or with the approval of the appropriate national authority of the State of Origin and the State of the Operator.

Column 12 "Cargo aircraft only – Packing instruction" – this column provides information similar to that in column 10, but for articles or substances which may be transported on a cargo aircraft only.

Column 13 "Cargo aircraft only – Maximum net quantity per package" – this column provides information similar to that in column 11, but for articles or substances which may be transported on a cargo aircraft only. The maximum quantity per package may be further limited by the type of packaging used. The maximum net quantities indicated do not apply to transport in portable tanks, as permitted, with the approval of the appropriate authority of the State of Origin and the State of the Operator. The maximum net quantities indicated may be exceeded only if specified in these Instructions or as permitted with the approval of the appropriate national authority of the State of Origin and the State of the Operator.

(2) The following abbreviations or symbols are used in Table 3-1 and have the meanings shown:

Abbreviation	***Column***	***Meaning***
n.o.s.	1	Not otherwise specified
g	11 and 13	gram(s)

ml	11 and 13	millilitre(s)
L	11 and 13	Litre(s)
kg	11 and 13	Kilogram(s)
G	11	Gross mass of package as prepared for transport

Segment 3 Section 3

SPECIAL PROVISIONS

3.1 Table 3-2 lists the special provisions referred to in column 7 of Table 3-1 and the information contained in them is additional to that shown for the relevant entry. Where the wording of the special provision is equivalent to that in the UN Model Regulations, the UN special provision number is shown in parentheses. Where the wording of the special provision is related to but not equivalent to that in the UN Model Regulations, the UN special provision number preceded by "≈" is shown in parentheses.

3.2 Where a special provision includes a requirement for package marking, the provisions of Part 5;2.2 must be met. If the required mark is in the form of specific wording indicated in quotation marks, the size of the mark must be at least 12 mm, unless otherwise indicated in the special provision or elsewhere in these Instructions.

Special Provisions

TIs	*UN*	
A1		• This article or substance may be transported on passenger aircraft only with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the written conditions established by those authorities. The conditions must include the quantity limitations and packing requirements and these must comply with S-3;1.2.2 of the Supplement. A copy of the document(s) of approval, showing the quantity limitations and packing requirements, must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document. The article or substance may be carried on cargo aircraft in accordance with columns 12 and 13 of Table 3-1. • When States, other than the State of Origin and the State of the Operator, have notified ICAO that they require prior approval of shipments made under this special provision, approval must also be obtained from these States, as appropriate.
A2		• This article or substance may be transported on cargo aircraft only with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the written conditions established by those authorities. • When States, other than the State of Origin and the State of the Operator, have notified ICAO that they require prior approval of shipments made under this special provision, approval must also be obtained from the States of Transit, Overflight and Destination, as appropriate. • In each case, the conditions must include the quantity limitations and packing requirements and these must comply with S-3;1.2.3 of the Supplement. A copy of the document(s) of approval, showing the quantity limitations and the packing and labelling requirements, must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document.
A3	(223)	• If the chemical or physical properties of a substance covered by this description are such that, when tested, it does not meet the established defining criteria for the class or division listed in column 3, or any other class or division, it is not subject to these Instructions.
A4		• Liquids having a vapour inhalation toxicity of Packing Group I are forbidden on both passenger and cargo aircraft. • Liquids having a mist inhalation toxicity of Packing Group I are forbidden on a passenger aircraft. They may be carried on cargo aircraft providing they are packed in accordance with the packing instructions for the Packing Group I substance and the maximum net quantity per package does not exceed 5 L, except where the limit specified in column 13 of Table 3-1 is less than 5 L, in which case the limit specified in column 13 applies. Transport in accordance with this special provision must be noted on the dangerous goods transport document.

TIs *UN*

A5		• Solids having an inhalation toxicity of Packing Group I are forbidden on passenger aircraft. They may be carried on cargo aircraft providing they are packed in accordance with the packing instructions for the Packing Group I substance and the maximum net quantity per package does not exceed 15 kg. Transport in accordance with this special provision must be noted on the dangerous goods transport document.
A6	(43)	• When offered for carriage as pesticides, these substances must be carried under the relevant pesticide entry and in accordance with the relevant pesticide provisions (see 2;6.2.3 and 2;6.2.4).
A7		• Not used.
A8	(322)	• When transported in non-friable tablet form, these goods are assigned to Packing Group III.
A9	(≈145)	• Alcoholic beverages containing not more than 70 per cent alcohol by volume, when packed in receptacles of 5 litres or less, are not subject to these Instructions when carried as cargo.
A10	(39)	• This substance is not subject to these Instructions when it contains less than 30 per cent or not less than 90 per cent silicon.
A11	(305)	• These substances are not subject to these Instructions when in concentrations of not more than 50 mg/kg.
A12	(45)	• Antimony sulphides and oxides which contain not more than 0.5 per cent of arsenic calculated on the total mass are not subject to these Instructions.
A13	(47)	• Ferricyanides and ferrocyanides are not subject to these Instructions.
A14		• Not used.
A15	(59)	• These substances are not subject to these Instructions when they contain not more than 50 per cent magnesium.
A16	(62)	• This substance is not subject to these Instructions when it does not contain more than 4 per cent sodium hydroxide.
A17	(≈288)	• These substances must not be classified and transported unless authorized by the appropriate authority of the State in which the dangerous goods were manufactured on the basis of results from Series 2 tests and a Series 6(c) test of the UN *Manual of Tests and Criteria* on packages as prepared for transport.
A18	(66)	• Cinnabar is not subject to these Instructions.
A19	(225)	• Fire extinguishers under this entry may include installed actuating cartridges (cartridges, power device of Division 1.4C or 1.4S), without changing the classification of Division 2.2 provided the total quantity of deflagrating (propellant) explosives does not exceed 3.2 g per extinguishing unit. Fire extinguishers must be manufactured, tested, approved and labelled according to the provisions applied in the State of Manufacture. Fire extinguishers under this entry include: *Note.— Provisions applied in the State of Manufacture means the provisions applicable in the State of Manufacture or those applicable in the State of use.* a) portable fire extinguishers for manual handling and operation; *Note.— Fire extinguishers may be considered portable even if some components that are necessary for their proper functioning (such as hoses and nozzles) are temporarily detached, as long as the safety of the pressurized extinguishing agent containers is not compromised and the fire extinguishers continue to be identified as portable fire extinguishers.* b) fire extinguishers for installation in aircraft; c) fire extinguishers mounted on wheels for manual handling; d) fire extinguishing equipment or machinery mounted on wheels or wheeled platforms or units transported similar to (small) trailers; and e) fire extinguishers composed of a non-rollable pressure drum and equipment, and handled, for example, by fork lift or crane when loaded or unloaded. Cylinders which contain gases for use in the above-mentioned extinguishers or for use in stationary firefighting installations must meet the requirements in Part 6;5 and all requirements applicable to the relevant dangerous goods when these cylinders are transported separately.

TIs	*UN*	
A20		• During the course of transport this substance must be protected from direct sunlight and all sources of heat and be placed in an adequately ventilated area. A statement to this effect must be included in the dangerous goods transport document.
A21		• Not used.
A22	(152)	• The classification of this substance will vary with particle size and packaging, but borderlines have not been experimentally determined. The appropriate classification must be made using the procedure for the classification of explosives.
A23	(325)	• In the case of non-fissile or fissile excepted uranium hexafluoride, the material must be classified under UN 2978.
A24		• The total quantity of explosive substance contained in the shaped charges and the detonating cord must not exceed 10 kg per assembled perforating gun.
A25	(205)	• This entry must not be used for Pentachlorophenol (UN 3155).
A26	(119)	• Refrigerating machines include air conditioning units and machines or other appliances which have been designed for the specific purpose of keeping food or other items at low temperature in an internal compartment. Refrigerating machines and refrigerating machine components are considered not subject to these Instructions if containing less than 12 kg of a gas in Division 2.2 or if containing less than 12 L ammonia solution (UN 2672).
A27	(276)	• This includes any substance which is not covered by any of the other classes but which has narcotic, noxious or other properties such that, in the event of spillage or leakage on an aircraft, extreme annoyance or discomfort could be caused to crew members so as to prevent the correct performance of assigned duties.
A28	(135)	• The dihydrated sodium salt of dichloroisocyanuric acid does not meet the criteria for inclusion in Division 5.1 and is not subject to these Instructions unless meeting the criteria for inclusion in another class or division.
A29	(138)	• p-Bromobenzyl cyanide is not subject to these Instructions.
A30	(273)	• Maneb and maneb preparations stabilized against self-heating need not be classified in Division 4.2 when it can be demonstrated by testing that a cubic metre of the substance does not self-ignite and that the temperature at the centre of the sample does not exceed 200°C, when the sample is maintained at a temperature of not less than 75°C ± 2°C for a period of 24 hours.
A31	(141)	• Products which have undergone sufficient heat treatment, so they present no hazard during transport are not subject to these Instructions.
A32	(≈289)	• Safety devices, electrically initiated and safety devices, pyrotechnic installed in vehicles, vessels or aircraft or in completed components such as steering columns, door panels, seats, etc., which are not capable of inadvertent activation are not subject to these Instructions when carried as cargo. The words “not restricted” and the special provision number A32 must be provided on the air waybill when an air waybill is issued.
A33	(103)	• Ammonium nitrites and mixtures of an inorganic nitrite with an ammonium salt are forbidden.
A34	(113)	• The transport of chemically unstable mixtures is forbidden.
A35		• This substance is not subject to these Instructions when: — mechanically produced, particle size of 53 microns or more; or — chemically produced, particle size of 840 microns or more.
A36		• The provisions of Special Provision A1 apply to this entry for Packing Group II only.
A37	(≈206)	• This entry is not intended to include Ammonium permanganate, the transport of which is forbidden under any circumstances.
A38	(207)	• Moulding compounds may be made from polystyrene, poly(methyl methacrylate) or other polymeric material.
A39	(≈26)	• This substance possesses some dangerous explosive properties when transported in large volumes.

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A40	(28)	• This substance may be transported under provisions of Class 3 or Division 4.1 only if it is so packed that the percentage of diluent will not fall below that stated at any time during transport (see 2;3.1.4 and 2;4.2.4). In cases where the diluent is not stated, the substance must be packed so that the amount of explosive substance does not exceed the stated value.

Tls	*UN*	
A41		• Permeation devices that contain dangerous goods and that are used for calibrating air quality monitoring devices are not subject to these Instructions when carried as cargo provided the following requirements are met: a) Each device must be constructed of a material compatible with the dangerous goods it contains; b) The total contents of dangerous goods in each device is limited to 2 millilitres and the device must not be liquid full at 55°C; c) Each permeation device must be placed in a sealed, high impact-resistant, tubular inner packaging of plastic or equivalent material. Sufficient absorbent material must be contained in the inner packaging to completely absorb the contents of the device. The closure of the inner packaging must be securely held in place with wire, tape or other positive means; d) Each inner packaging must be contained in a secondary packaging constructed of metal, or plastic having a minimum thickness of 1.5 mm. The secondary packaging must be hermetically sealed; e) The secondary packaging must be securely packed in strong outer packaging. The completed package must be capable of withstanding, without breakage or leakage of any inner packaging and without significant reduction in effectiveness: i) the following free drops onto a rigid, non-resilient, flat and horizontal surface from a height of 1.8 m: — one drop flat on the bottom; — one drop flat on the top; — one drop flat on the long side; — one drop flat on the short side; — one drop on a corner at the junction of three intersecting edges; and ii) a force applied to the top surface for a duration of 24 hours, equivalent to the total weight of identical packages if stacked to a height of 3 m (including the test sample). *Note. — Each of the above tests may be performed on different but identical packages.* f) The gross mass of the completed package must not exceed 30 kg.
A42	(249)	• Ferrocerium (lighter flints), stabilized against corrosion, with a minimum iron content of 10 per cent are not subject to these Instructions.
A43	(210)	• Toxins from plants, animal or bacterial sources which contain infectious substances, or toxins that are contained in infectious substances, must be classified as Division 6.2.
A44	(≈251)	• The entry chemical kit or first-aid kit is intended to apply to boxes, cases, etc., containing small quantities of various dangerous goods which are used, for example, for medical, analytical or testing or repair purposes. Components must not react dangerously (see 4;1.1.8). The packing group assigned to the kit as a whole must be the most stringent packing group assigned to any individual substance in the kit. The assigned packing group must be shown on the dangerous goods transport document. Where the kit contains only dangerous goods to which no packing group is assigned, a packing group must not be indicated on the dangerous goods transport document. Such kits must only contain dangerous goods that are permitted as: a) excepted quantities not exceeding the quantity indicated by the code in column 9 of Table 3-1, provided that the quantity per inner packaging and quantity per package are as prescribed in 5.1.2 and 5.1.3 and the inner packagings are as prescribed in 5.2 a); or b) limited quantities as prescribed under 3;4.1.2.

A45		• Not used. *Note. — See Packing Instructions 965-970.*
A46	(≈216)	• Mixtures of solids which are not subject to these Instructions and flammable liquids may be transported under this entry without first applying the classification criteria of Division 4.1, providing there is no free liquid visible at the time the substance is packaged and, for single packaging, the packaging must pass a leak proofness test at the Packing Group II level. Sealed packets and articles containing less than 10 mL of a Packing Group II or III flammable liquid absorbed into a solid material are not subject to these Instructions provided there is no free liquid in the packet or articles.

TIs	*UN*	
A47	(219)	• Genetically modified micro-organisms (GMMOs) and genetically modified organisms (GMOs) packed and marked in accordance with Packing Instruction 959 are not subject to any other requirements in these Instructions when carried as cargo. • If GMMOs or GMOs meet the definition in 2;6 of a toxic substance or an infectious substance and meet the criteria for inclusion in Division 6.1 or 6.2, the requirements in these Instructions for transporting toxic substances or infectious substances apply.
A48		• Packaging tests are not considered necessary.
A49	(≈127)	• Other inert material or inert material mixture may be used at the discretion of the appropriate authority of the State in which the dangerous goods were manufactured, provided this inert material has identical phlegmatizing properties.
A50	(≈217)	• Mixtures of solids which are not subject to these Instructions and toxic liquids may be transported under this entry without first applying the classification criteria of Division 6.1, providing there is no free liquid visible at the time the substance is packaged and, for single packagings, the packaging must pass a leakproofness test at the Packing Group II level. This entry must not be used for solids containing a Packing Group I liquid.
A51		• Irrespective of the limit specified in column 11 of Table 3-1, aircraft batteries up to a limit of 100 kg net mass per package may be transported. Transport in accordance with this special provision must be noted on the dangerous goods transport document. *Note. — This special provision applies to* UN 2794 **Batteries, wet, filled with acid** *and* UN 2795 **Batteries, wet, filled with alkali** *only.*
A52	(228)	• Mixtures not meeting the criteria for flammable gases (Division 2.1) must be transported under UN 3163.
A53	(37)	• This substance is not subject to these Instructions when coated.
A54	(32)	• This substance is not subject to these Instructions when in any other form.
A55	(142)	• Solvent extracted soya bean meal containing not more than 1.5 per cent oil and not more than 11 per cent moisture, which is substantially free of flammable solvent, is not subject to these Instructions.
A56	(235)	• This entry applies to articles which contain Class 1 explosive substances, and which may also contain dangerous goods of other classes. These articles are used to enhance safety in vehicles, vessels or aircraft (such as air bag inflators, air bag modules, seat belt pretensioners and pyromechanical devices). *Note. — For the carriage of a vehicle, see Packing Instruction 950, 951 and 952.*
A57		• Not used.
A58	(144)	• An aqueous solution containing not more than 24 per cent alcohol by volume is not subject to these Instructions.
A59		• A tire assembly that is unserviceable or damaged is not subject to these Instructions if the tire is deflated to a gauge pressure of less than 200 kPa at 20ºC. A tire assembly with a serviceable tire is not subject to these Instructions provided the tire is not inflated to a gauge pressure exceeding the maximum rated pressure for that tire. However, such tires (including valve assemblies) must be protected from damage during transport, which may require the use of a protective cover.

	A60	(215)	• This entry only applies to the technically pure substance or to formulations derived from it having an SADT higher than 75□C and therefore does not apply to formulations which are self-reactive substances. (For self-reactive substances, see 2;4.2.3. Table 2-6). Homogeneous mixtures containing not more than 35 per cent by mass of azodicarbonamide and at least 65 per cent of inert substance are not subject to these Instructions unless criteria of other classes or divisions are met.
	A61	(168)	• Asbestos which is immersed or fixed in a natural or artificial binder (such as cement, plastics, asphalt, resins or mineral ore) in such a way that no escape of hazardous quantities of respirable asbestos fibres can occur during transport is not subject to these Instructions. Manufactured articles, containing asbestos and not meeting this requirement, are nevertheless not subject to these Instructions, when packed so that no escape of hazardous quantities of respirable asbestos fibres can occur during transport. • The words "not restricted" and the special provision number A61 must be provided on the air waybill when an air waybill is issued.
	A62	(178)	• This designation may only be used when no other appropriate designation exists in the list and then only with the approval of the appropriate authority of the State in which the dangerous goods were manufactured.

	TIs	*UN*	
	A63		• Not used.
	A64	(306)	• This entry may only be used for substances that are too insensitive for acceptance into Class 1 when tested in accordance with test series 2 (see UN *Manual of Tests and Criteria*, Part I).
	A65	(270)	• Aqueous solutions of Division 5.1 inorganic solid nitrate substances are considered as not meeting the criteria of Division 5.1 if the concentration of the substances in solution at the minimum temperature encountered in transport is not greater than 80 per cent of the saturation limit.
	A66	(236)	• Polyester resin kits consist of two components: base material (either Class 3 or Division 4.1, Packing Group II or III) and an activator (organic peroxide). The organic peroxide must be type D, E or F, not requiring temperature control. The packing group must be Packing Group II or III, according to the criteria for either Class 3 or Division 4.1, as appropriate, applied to the base material.
≠	**A67**	(≈238)	• Batteries can be considered non-spillable provided that they are capable of withstanding the vibration and pressure differential tests given below, without leakage of battery fluid. • ***Vibration test*:** The battery is rigidly clamped to the platform of a vibration machine and a simple harmonic motion having an amplitude of 0.8 mm (1.6 mm maximum total excursion) is applied. The frequency varies at the rate of 1 Hz/min between the limits of 10 Hz to 55 Hz. The entire range of frequencies and return is traversed in 95 ± 5 minutes for each mounting position (direction of vibration) of the battery. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for equal time periods. • ***Pressure differential test*:** Following the vibration test, the battery is stored for six hours at 24°C ±4°C while subjected to a pressure differential of at least 88 kPa. The battery must be tested in three mutually perpendicular positions (to include testing with fill openings and vents, if any, in an inverted position) for at least six hours in each position. *Note. — Non-spillable type batteries which are an integral part of, and necessary for the operation of, mechanical or electronic equipment must be securely fastened in the battery holder on the equipment and protected in such a manner so as to prevent damage and short circuits.* Non-spillable batteries are not subject to these Instructions when carried as cargo if, at a temperature of 55°C, the electrolyte will not flow from a ruptured or cracked case. The battery must not contain any free or unabsorbed liquid. Any electrical battery or battery-powered device, equipment or vehicle must be prepared for transport so as to prevent: a) a short circuit (such as in the case of batteries, by the effective insulation of exposed terminals; or, in the case of equipment, by disconnection of the battery and protection of exposed terminals); and b) unintentional activation. The words "not restricted" and the special provision number A67 must be provided on the air waybill when an air waybill is issued.
	A68	(272)	• This substance must not be transported under the provisions of Division 4.1 unless specifically authorized by the appropriate national authority. **(See UN 0143 or UN 0150 as appropriate.)**

≠	**A69**		• The following are not subject to these Instructions when carried as cargo: a) articles other than lamps, such as thermometers, switches and relays, each containing a total quantity of not more than 15 g of mercury or gallium, if they are installed as an integral part of a machine or apparatus and so fitted that shock or impact damage, leading to leakage of mercury or gallium, is unlikely to occur under normal conditions of transport. b) articles other than lamps, each containing not more than 100 mg of mercury, gallium or inert gas and packaged so that the quantity of mercury, gallium or inert gas per package is 1 g or less. The words “not restricted” and the special provision number A69 must be provided on the air waybill when an air waybill is issued. *Note. — For lamps containing dangerous goods, see Part 1;2.6.*

		TIs	*UN*	
≠	**A70**			• Internal combustion or fuel cell engines or machinery being shipped either separately or incorporated into a vehicle, machine or other apparatus, without batteries or other dangerous goods, are not subject to these Instructions when carried as cargo provided that: a) for liquid-fuel-powered engines: 1) The engine is powered by a liquid fuel that does not meet the classification criteria for any class or division; or 2) The fuel tank of the vehicle, machine or other apparatus has never contained any fuel, or the fuel tank has been flushed and purged of vapours and adequate measures taken to nullify the hazard; and 3) The entire fuel system of the engine has no free liquid, and all fuel lines are sealed or capped or securely connected to the engine and vehicle, machinery or apparatus. b) for flammable-gas-powered internal combustion or fuel cell engines: 1) the entire fuel system must have been flushed, purged and filled with a non-flammable gas or fluid to nullify the hazard; 2) the final pressure of the non-flammable gas used to fill the system does not exceed 200 kPa at 20°C; 3) the shipper has made prior arrangements with the operator; and 4) The shipper has provided the operator with written or electronic documentation stating that the flushing, purging and filling procedure has been followed and that the final contents of the engine(s) have been tested and verified to be non-flammable. Multiple engines may be shipped in a unit load device provided that the shipper has made prior arrangements with the operator(s) for each shipment. When this special provision is used, the words “not restricted” and the special provision number A70 must be provided on the air waybill when an air waybill is issued.
	A71	(38)		• This substance is not subject to these Instructions when it contains not more than 0.1 per cent calcium carbide.
	A72	(163)		• A substance specifically listed by name in Table 3-1 must not be transported under this entry. Substances transported under this entry may contain 20 per cent or less nitrocellulose provided the nitrocellulose contains not more than 12.6 per cent nitrogen.
	A73	(237)		• The membrane filters, including paper separators, coating, or backing materials, etc., that are present in transport, must not be liable to propagate a detonation as tested by one of the tests described in the UN *Manual of Tests and Criteria*, Part I, Test Series 1(a).

		• In addition, the appropriate authority may determine, on the basis of the results of suitable burning rate tests taking account of the standard tests in the UN *Manual of Tests and Criteria,* Part III, subsection 33.2.1, that nitrocellulose membrane filters in the form in which they are to be transported are not subject to the provisions of these Instructions applicable to flammable solids in Division 4.1.
A74	(169)	• Phthalic anhydride in the solid state and tetrahydrophthalic anhydrides, with not more than 0.05 per cent maleic anhydride, are not subject to these Instructions. Phthalic anhydride molten at a temperature above its flash point, with not more than 0.05 per cent maleic anhydride, must be classified under UN 3256.
A75		• Articles such as sterilization devices, when containing less than 30 mL per inner packaging with not more than 150 mL per outer packaging, may be transported on passenger and cargo aircraft in accordance with the provisions in 3;5, irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided such packagings were first subjected to comparative fire testing. Comparative fire testing between a package as prepared for transport (including the substance to be transported) and an identical package filled with water must show that the maximum temperature measured inside the packages during testing does not differ by more than 200°C. Packagings may include a vent to permit the slow escape of gas (that is, not more than 0.1 mL/hour per 30 mL inner packaging at 20°C) produced from gradual decomposition. The requirements of 4;1.1.6, 4;1.1.12 and 4;7.1.2 do not apply.
A76	(326)	• In the case of fissile uranium hexafluoride, the material must be classified under UN 2977.

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A77	(≈218)	• Mixtures of solids which are not subject to these Instructions and corrosive liquids may be transported under this entry without first applying the classification criteria of Class 8, providing there is no free liquid visible at the time the substance is packaged and, for single packaging, the packaging must pass a leak proofness test at the Packing Group II level.
A78	(≈172)	• Where a radioactive material has a subsidiary hazard(s): a) The substance must be allocated to Packing Group I, II or III, if appropriate, by application of the packing group criteria provided in Part 2 corresponding to the nature of the predominant subsidiary hazard. b) Packages must be labelled with subsidiary hazard labels corresponding to each subsidiary hazard exhibited by the material in accordance with the relevant provisions of 5;3.2; corresponding placards must be affixed to cargo transport units in accordance with the relevant provisions of 5;3.6. c) For the purposes of documentation and package marking, the proper shipping name must be supplemented with the name of the constituents which most predominantly contribute to this subsidiary hazard(s) and which must be enclosed in parenthesis. However, where the constituent is listed by name in Table 3-1 and: i) **"forbidden"** is shown in columns 10 and 11, the dangerous goods transport document must indicate Cargo Aircraft Only and the package must bear cargo aircraft only labels, except that the substance may be shipped on a passenger aircraft with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the conditions established by those authorities. A copy of the document of approval, showing the quantity limitations and the packaging requirements, must accompany the consignment; and ii) **"forbidden"** is shown in columns 12 and 13, the substance is forbidden for transport by air except that the substance may be shipped on a cargo aircraft with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the conditions established by those authorities. A copy of the document of approval, showing the quantity limitations and the packaging requirements, must accompany the consignment. Radioactive material with a subsidiary hazard of Division 4.2 in Packing Group I must be transported in Type B packages. These may be transported on passenger or cargo aircraft. d) The dangerous goods transport document must indicate the class or division of the subsidiary hazard and, where assigned, the packing group as required by 5;4.1.4.1 d) and e). For packing, see also 4;9.1.5.

A79	(307)	•	This entry may only be used for ammonium nitrate fertilizers. They must be classified in accordance with the procedure as set out in the *Manual of Tests and Criteria*, Part III, Section 39.
A80	(220)	•	The technical name of the flammable liquid component only of this solution or mixture must be shown in parenthesis immediately following the proper shipping name.
A81		•	The quantity limits shown in columns 11 and 13 do not apply to body parts, organs or whole bodies.
A82	(177)	•	Barium sulphate is not subject to these Instructions.
A83	(208)	•	The commercial grade of calcium nitrate fertilizer, when consisting mainly of a double salt (calcium nitrate and ammonium nitrate) containing not more than 10 per cent ammonium nitrate and at least 12 per cent water of crystallization, is not subject to these Instructions.
A84	(182)	•	The group of alkali metals includes lithium, sodium, potassium, rubidium and caesium.
A85	(183)	•	The group of alkaline earth metals includes magnesium, calcium, strontium and barium.
A86	(241)	•	The formulation must be prepared so that it remains homogeneous and does not separate during transport. Formulations with low nitrocellulose contents are not subject to these Instructions provided that 1) they do not exhibit dangerous properties when tested for their liability to detonate, deflagrate or explode when heated under defined confinement by tests of test series 1(a), 2(b) and 2(c) respectively in the UN *Manual of Tests and Criteria* and 2) they are not flammable solids when tested in accordance with test N1 in the UN *Manual of Tests and Criteria*, Part III, subsection 3.3.2.1.4 (chips, if necessary, crushed and sieved to a particle size of less than 1.25 mm).
A87		Articles which are not fully enclosed by packaging, crates or other means that prevent ready identification are not subject to the marking requirements of 5;2 or the labelling requirements of 5;3.	

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≠	**A88**		•	Pre-production prototypes of lithium cells or batteries, or sodium ion cells or batteries, when these prototypes are transported for testing or low production runs (that is, annual production runs consisting of not more than 100 lithium cells or batteries, or sodium ion cells or batteries) of lithium cells or batteries, or sodium ion cells or batteries that have not been tested to the requirements in Part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator and the requirements in Packing Instruction 910 of the Supplement are met.
			•	A copy of the document of approval including the quantity limitations must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document.
			•	Irrespective of the limit specified in column 13 of Table 3-1, the cell or battery as prepared for transport may have a mass exceeding 35 kg.
	A89	(186)	•	Not used.
	A90	(193)	•	This entry may only be used for ammonium nitrate based compound fertilizers. They must be classified in accordance with the procedure as set out in the UN *Manual of Tests and Criteria*, Part III, Section 39.
	A91	(198)	•	A nitrocellulose solution containing not more than 20 per cent nitrocellulose may be transported under the requirements for “Paint”, “Perfumery products” or “Printing ink” as applicable; see UN 1210, UN 1263, UN 1266, UN 3066, UN 3469 and UN 3470.
	A92	(199)	•	Lead compounds which, when mixed in a ratio of 1:1000 with 0.07 M hydrochloric acid and stirred for 1 hour at a temperature of 23°C ±2°C, exhibit a solubility of 5 per cent or less (see ISO 3711:1990 “*Lead chromate pigments and lead chromate-molybdate pigments – Specifications and methods of test”*) are considered insoluble and are not subject to these Instructions unless they meet the criteria for inclusion in another hazard class or division.
	A93		•	A heat-producing article is not subject to these Instructions when the heat-producing component or the energy source is removed to prevent unintentional functioning during transport. The words “not restricted” and the special provision number A93 must be provided on the air waybill when an air waybill is issued.

A94	(≈239)	• Batteries or cells containing sodium must not contain dangerous goods other than sodium, sulphur or sodium compounds (such as sodium polysulphides and sodium tetrachloroaluminate). Batteries or cells must not be offered for transport at a temperature such that liquid elemental sodium is present in the battery or cell unless approved and under the conditions established by the appropriate national authority. • Cells must consist of hermetically sealed metal casings which fully enclose the dangerous goods and which are so constructed and closed as to prevent the release of the dangerous goods under normal conditions of transport. • Batteries must consist of cells secured within and fully enclosed by a metal casing so constructed and closed as to prevent the release of the dangerous goods under normal conditions of transport.
A95	(203)	• This entry is not to be used for Polychlorinated biphenyls (UN 2315).
A96	(196)	• Only formulations which in laboratory testing neither detonate in the cavitated state nor deflagrate, which show no effect when heated under confinement and which exhibit no explosive power may be transported under this entry. The formulation must also be thermally stable (that is, the SADT is 60□C or higher for a 50 kg package). Formulations not meeting these criteria must be transported under the appropriate provisions of Division 5.2.
A97		• These entries must be used for substances which are hazardous to the environment but do not meet the classification criteria of any other class or other substance within Class 9. This must be based on the criteria as indicated in 2;9.2 a). This designation may also be used for wastes not otherwise subject to these Instructions, but which are covered under the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*.
A98		• Aerosols, gas cartridges and receptacles, small, containing gas with a capacity not exceeding 50 ml, containing no constituents subject to these Instructions other than a Division 2.2 gas, are not subject to these Instructions when carried as cargo unless their release could cause extreme annoyance or discomfort to crew members so as to prevent the correct performance of assigned duties. The words “not restricted” and the special provision number A98 must be provided on the air waybill when an air waybill is issued.

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≠	**A99**		• Irrespective of the quantity limits for cargo aircraft specified in column 13 of Table 3-1, and in Section I of Packing Instructions 965, 966, 967, 968, 969, 970, 976, 977 and 978, a lithium cell or battery, or sodium ion cell or battery (that is, UN 3090, UN 3480 or UN 3551), including when packed with equipment or contained in equipment (that is, UN 3091, UN 3481 or UN 3552) that meets the other requirements of Section I of the applicable packing instruction, may have a mass exceeding 35 kg, if approved by the appropriate authority of the State of Origin and the State of the Operator and the requirements in Packing Instruction 974 of the Supplement are met. • A copy of the document of approval must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document.
	A100	(243)	• Gasoline, motor spirit and petrol for use in spark-ignition engines (such as in automobiles, stationary engines and other engines) must be assigned to this entry regardless of variations in volatility.
	A101	(227)	• When phlegmatized with water and inorganic inert material, the content of urea nitrate may not exceed 75 per cent by mass, and the mixture must not be capable of being detonated by the series 1 type (a) test in the UN *Manual of Tests and Criteria*, Part I.
	A102	(244)	• This entry includes aluminium dross, aluminium skimming’s, spent cathodes, spent potliner and aluminium salt slags.
	A103	(≈291)	• Flammable liquefied gases must be contained within refrigerating machine components. These components must be designed and tested to at least three times the working pressure of the machinery. The refrigerating machines must be designed and constructed to contain the liquefied gas and preclude the risk of bursting or cracking of the pressure-retaining components during normal conditions of transport. Refrigerating machines and refrigerating machine components are considered not subject to these Instructions if containing less than 100 g flammable, non-toxic, liquefied gas.
	A104		• Not used.
	A105	(242)	• Sulphur is not subject to these Instructions when it has been formed to a specific shape (such as prills, granules, pellets, pastilles or flakes).

A106		• This entry may only be used for samples of chemicals taken for analysis in connection with the implementation of the Chemical Weapons Convention. • They may be transported on a passenger or cargo aircraft providing prior approval has been granted by the appropriate authority of the State of Origin or the Director General of the Organization for the Prohibition of Chemical Weapons and providing the samples comply with the requirements shown against the entry for chemical samples. • The substance is assumed to meet the criteria of Packing Group I for Division 6.1. Subsidiary hazard labelling is not required. • A copy of the document of approval showing the quantity limitations and the packing requirements must accompany the consignment. *Note. — The transport of substances under this description must be in accordance with chain of custody and security procedures specified by the Organization for the Prohibition of Chemical Weapons.*

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≠	**A107**	(≈301)	• This entry only applies to articles such as machinery, apparatus or devices containing dangerous goods as a residue or as an integral element of the articles. It must not be used for articles for which a proper shipping name already exists in Table 3-1. • Where the quantity of dangerous goods exceeds the limits permitted by Packing Instruction 962, and the dangerous goods meet the provisions of Special Provision 301 of the UN Model Regulations, the articles may be transported only with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the written conditions established by those authorities. • Notwithstanding the quantities specified in Packing Instruction 962, articles may also contain up to 5 kg of UN 3077 – **Environmentally hazardous substance, solid, n.o.s.** and/or 5 L of UN 3082 – **Environmentally hazardous substance, liquid, n.o.s.** The quantity of environmentally hazardous substance must not be indicated on the dangerous goods transport document. • Articles containing only UN 3077 – **Environmentally hazardous substance, solid, n.o.s.** and/or UN 3082 – **Environmentally hazardous substance, liquid, n.o.s.** in quantities not exceeding 5 kg or 5 L, respectively, are not subject to these Instructions. *Note. — Where the quantity of dangerous goods in the article exceeds the quantity permitted by Special Provision 301 of the UN Model Regulations, or the dangerous goods are not permitted as limited quantity by the UN Model Regulations, classification of the article must be in accordance with Part 2, Introductory Chapter, 6.1 to 6.6.*
	A108		• The provisions of Special Provision A1 apply to this entry for Packing Group I only.
	A109		• Not used.
	A110	(226)	• Formulations of these substances containing not less than 30 per cent non-volatile, non-flammable phlegmatizer are not subject to these Instructions.
	A111		• Oxygen generators, chemical, that have passed their expiration date, are unserviceable or that have been used are forbidden for transport.
	A112		• Consumer commodities may only include substances of Class 2 (non-toxic aerosols only), Class 3, Packing Group II or III, Division 6.1 (Packing Group III only), UN 3077, UN 3082, UN 3175, UN 3334 and UN 3335 provided such substances do not have a subsidiary hazard. Dangerous goods that are forbidden for transport aboard passenger aircraft must not be transported as consumer commodities.
	A113	(279)	• The substance is assigned to this classification or Packing Group based on human experience rather than the strict application of classification criteria set out in the Instructions.

A114	(283)	• Articles, containing gas, intended to function as shock absorbers, including impact energy absorbing devices, or pneumatic springs are not subject to these Instructions provided: a) each article has a gas space capacity not exceeding 1.6 litres and a charge pressure not exceeding 280 bar where the product of the capacity (litres) and charge pressure (bars) does not exceed 80 (that is, 0.5 litre gas space and 160 bar charge pressure, 1 litre gas space and 80 bar charge pressure, 1.6 litre gas space and 50 bar charge pressure, 0.28 litre gas space and 280 bar charge pressure); b) each article has a minimum burst pressure of 4 times the charge pressure at 20°C for products not exceeding 0.5 litre gas space capacity and 5 times charge pressure for products greater than 0.5 litre gas space capacity; c) each article is manufactured from material which will not fragment upon rupture; d) each article is manufactured in accordance with a quality assurance standard acceptable to the appropriate national authority; and e) the design type has been subjected to a fire test demonstrating that pressure in the article is relieved by means of a fire-degradable seal or other pressure-relief device such that the article will not fragment and the article does not rocket.

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≠	**A115**	(280)	• This entry applies to safety devices for vehicles, vessels or aircraft, such as air bag inflators, air bag modules, seat belt pretensioners, and pyromechanical devices and which contain dangerous goods of Class 1 or dangerous goods of other classes and when transported as component parts and if these articles as presented for transport have been tested in accordance with test series 6 (c) of Part I of the UN *Manual of Tests and Criteria*, with no explosion of the device, no fragmentation of the device casing or pressure receptacle, and no projection hazard or thermal effect which would significantly hinder firefighting or other emergency response efforts in the immediate vicinity. • This entry does not apply to life saving appliances described in Packing Instruction 955 (UN Nos. 2990 and 3072) or to fire suppressant dispersing devices (UN Nos. 0514 and 3559).
	A116	(≈284)	• An oxygen generator, chemical, when containing an explosive actuating device must only be transported under this entry when excluded from Class 1 in accordance with 2;1.1 b).
	A117		• Wastes containing Category A infectious substances must be assigned to UN 2814, UN 2900 or UN 3549, as applicable. Wastes transported under UN 3291 are wastes containing infectious substances in Category B or wastes that are reasonably believed to have a low probability of containing infectious substances. Decontaminated wastes which previously contained infectious substances may be considered as not subject to these Instructions unless the criteria of another class or division are met.
	A118		• Items classified as explosive must be removed from vehicles and transported in accordance with the provisions of these Instructions unless authorized by the appropriate national authority under the written conditions established by that authority. In such circumstances, vehicles may be transported on cargo aircraft only. *Note.— This special provision does not apply where the explosives are a smoke candle installed as a permanent part of the vehicle or are part of an assembly classified as dangerous goods of other than Class 1, such as Air bag inflators, Air bag modules and Seat-belt pretensioners (UN 3268), Fire extinguishers (UN 1044). Additionally, this special provision does not apply in the case of Air bag modules and Air bag inflators and Seatbelt pretensioners (UN 0503) installed in the vehicle.*
	A119		• Irrespective of the limit specified in column 13 of Table 3-1, a handling device meeting the requirements of Packing Instruction 961 as prepared for transport may have a gross mass not exceeding 1 000 kg.
	A120		• This entry includes but is not limited to automobiles, motorcycles, aircraft, boats, snowmobiles, jet skis, etc.
	A121		• Not used.
	A122	(286)	• Nitrocellulose membrane filters covered by this entry, each with a mass not exceeding 0.5 g, are not subject to these Instructions when contained individually in an article or a sealed packet.

≠	**A123**		• This entry applies to Batteries, electric storage, not otherwise listed in Table 3-1. Examples of such batteries are: alkali-manganese, zinc-carbon and nickel-cadmium batteries. Any electrical battery or battery-powered device, equipment or vehicle must be prepared for transport so as to prevent: a) a short circuit (such as in the case of batteries, by the effective insulation of exposed terminals; or, in the case of equipment, by disconnection of the battery and protection of exposed terminals); and b) unintentional activation. • The words "not restricted" and the special provision number A123 must be provided on the air waybill when an air waybill is issued. • Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.
	A124	(292)	• Not used.
	A125	(293)	• The following definitions apply to matches: a) Fuse matches are matches the heads of which are prepared with a friction-sensitive igniter composition and a pyrotechnic composition which burns with little or no flame, but with intense heat; b) Safety matches are matches combined with or attached to the box, book or card which can be ignited by friction only on a prepared surface;

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		c) Strike anywhere matches are matches that can be ignited by friction on a solid surface; d) Wax Vesta matches are matches that can be ignited by friction either on a prepared surface or on a solid surface.
	A126	• Not used.
	A127	• Not used.
	A128	(153) • This entry only applies if it is demonstrated, on the basis of tests, that the substances, when in contact with water are not combustible nor show a tendency to auto-ignition and that the mixture of gases evolved is not flammable.
≠	**A129**	(252) • Ammonium nitrate hot concentrated solutions can be transported under this entry provided: a) the solution contains not more than 93 per cent ammonium nitrate; b) the solution contains at least 7 per cent water; c) the solution contains not more than 0.2 per cent combustible material; d) the solution contains no chlorine compounds in quantities such that the chloride ion level exceeds 0.02 per cent; e) the pH of an aqueous solution of 10 per cent of the substance is between 5 and 7, measured at 25ºC; and f) the maximum allowable transport temperature of the solution is 140ºC. Ammonium nitrate hot concentrate solutions are not subject to these Instructions when carried as cargo, provided: a) the solution contains not more than 80 per cent ammonium nitrate; b) the solution contains not more than 0.2 per cent combustible material; c) the ammonium nitrate remains in solution under all conditions of transport; and d) the solution does not meet the criteria of any other class or division.

A130	(290)	• When this radioactive material meets the definitions and criteria of other classes or divisions as defined in Part 2, it must be classified in accordance with the following: a) Where the substance meets the criteria for dangerous goods in excepted quantities as set out in 3;5, the packagings must be in accordance with 3;5.2 and meet the testing requirements of 3;5.3. All other requirements applicable to radioactive material, excepted packages as set out in 1;6.1.5 apply without reference to the other class or division; b) Where the quantity exceeds the limits specified in 3;5.1.2, the substance must be classified in accordance with the predominant subsidiary hazard. The dangerous goods transport document must describe the substance with the proper shipping name and UN number applicable to the other class supplemented with the name applicable to the radioactive excepted package according to column 1 of the Dangerous Goods List, and must be transported in accordance with the provisions applicable to that UN number. An example of the information shown on the dangerous goods transport document is: UN 1993 Flammable liquid, n.o.s. (ethanol and toluene mixture), Radioactive material, excepted package – limited quantity of material, Class 3, PG II The radioactive material, excepted package label (Figure 5-33) is not required on packages meeting the conditions set out in this sub-paragraph. To aid acceptance, it is recommended that "A130" be indicated on the dangerous goods transport document. In addition, the requirements of 2;7.2.4.1.1 apply; c) The provisions of 3;4 for the transport of dangerous goods packed in limited quantities do not apply to substances classified in accordance with sub-paragraph b); d) When the substance meets a special provision that excepts this substance from all dangerous goods provisions of the other classes, it must be classified in accordance with the applicable UN number of Class 7 and all requirements specified in 1;6.1.5 apply.

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A131	(342)	• Glass inner receptacles (such as ampoules or capsules) intended only for use in sterilization devices, when containing less than 30 mL of ethylene oxide per inner packaging with not more than 300 mL per outer packaging, may be transported in accordance with the provisions in 3;5, irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided that: a) After filling, each glass inner receptacle has been determined to be leak-tight by placing the glass inner receptacle in a hot water bath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55°C is achieved. Any glass inner receptacle showing evidence of leakage, distortion or other defect under this test must not be transported under the terms of this special provision; b) in addition to the packaging required by 3;5.2, each glass inner receptacle is placed in a sealed plastic bag compatible with ethylene oxide and capable of containing the contents in the event of breakage or leakage of the glass inner receptacle; and c) each glass inner receptacle is protected by a means of preventing puncture of the plastic bag (such as sleeves or cushioning) in the event of damage to the packaging (such as by crushing).
A132	(204)	• Articles containing smoke-producing substance(s) corrosive according to the criteria for Class 8 must be labelled with a "Corrosive" subsidiary hazard label. Articles containing smoke-producing substance(s) toxic by inhalation according to the criteria for Division 6.1 must be labelled with a "TOXIC" subsidiary hazard label (Figure 5-18).
A133	(311)	• Substances must not be transported under this entry unless approved by the appropriate national authority based on the results of appropriate tests according to Part I of the UN *Manual of Tests and Criteria*. Packaging must ensure that the percentage of diluent does not fall below that stated in the appropriate authority approval at any time during transport.
A134	(312)	• Not used.
A135	(313)	• Not used.
A136	(314)	• a) These substances are liable to exothermic decomposition at elevated temperatures. Decomposition can be initiated by heat or by impurities (such as powdered metals (iron, manganese, cobalt, magnesium) and their compounds). • b) During the course of transport, these substances must be shaded from direct sunlight and all sources of heat and be placed in adequately ventilated areas.

A137	(315)	• This entry must not be used for Division 6.1 substances that meet the inhalation toxicity criteria for Packing Group I described in 2;6.
A138	(316)	• This entry applies only to calcium hypochlorite, dry, when transported in non-friable tablet form.
A139	(317)	• "Fissile-excepted" applies only to those packages complying with 2;7.
A140	(318)	• For the purposes of documentation, the proper shipping name must be supplemented with the technical name. Technical names need not be shown on the package. When the infectious substances to be transported are unknown but suspected of meeting the criteria for inclusion in category A and assignment to UN 2814 or UN 2900, the words "suspected category A infectious substance" must be shown, in parentheses, following the proper shipping name on the transport document, but not on the outer packagings.
A141		• Not used.
A142		• Not used.
A143	(321)	• These storage systems must always be considered as containing hydrogen.
A144		• Protective breathing equipment (PBE) containing a small chemical oxygen generator for use by aircrew members may be transported on passenger aircraft in accordance with Packing Instruction 565 subject to the following conditions: a) the PBE must be serviceable and contained in the manufacturer's original unopened inner packaging (that is, vacuum sealed bag and protective container);
		b) the PBE may only be consigned by, or on behalf of, an operator in the event that a PBE(s) has been rendered unserviceable or has been used and there is a need to replace such items so as to restore the number of PBEs on an aircraft to that required by pertinent airworthiness requirements and operating regulations;

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		c) a maximum of two PBE may be contained in a package; d) the statement "Aircrew protective breathing equipment (smoke hood) in accordance with Special Provision A144" must be: (i) included on the dangerous goods transport document; (ii) marked adjacent to the proper shipping name on the package. If the above conditions are met, the requirements of Special Provision A1 do not apply. All other requirements applicable to chemical oxygen generators must apply except that the "cargo aircraft only" handling label must not be displayed.
	A145	• Waste aerosols, waste gas cartridges and waste receptacles, small, containing gas are forbidden from air transport. Waste gas cartridges and waste receptacles, small, containing gas that were filled with gases of Division 2.2 and have been pierced are not subject to these Instructions.
≠	**A146** (328)	• This entry applies to fuel cell cartridges including when contained in equipment or packed with equipment. Fuel cell cartridges installed in or integral to a fuel cell system are regarded as contained in equipment. Fuel cell cartridge means an article that stores fuel for discharge into the fuel cell through a valve(s) that controls the discharge of fuel into the fuel cell. Fuel cell cartridges, including when contained in equipment, must be designed and constructed to prevent fuel leakage under normal conditions of transport. • Fuel cell cartridge design types using liquids as fuels must pass an internal pressure test at a pressure of 100 kPa (gauge) without leakage. • Except for fuel cell cartridges containing hydrogen in metal hydride which must be in compliance with A162, each fuel cell cartridge design type, including fuel cell cartridges installed in or integral to a fuel cell system, must be shown to pass a 1.2 metre drop test onto an unyielding surface in the orientation most likely to result in failure of the containment system with no loss of contents. • When lithium metal batteries, lithium-ion batteries or sodium ion batteries are contained in the fuel cell system, the consignment must be consigned under this entry and under the appropriate entries for UN 3091 **Lithium metal batteries contained in equipment**, UN 3481 **Lithium ion batteries contained in equipment** or UN 3552 **Sodium ion batteries contained in equipment**.

A147	(329)	•	Not used.
A148	(330)	•	Not used.
A149		•	Not used.
A150		•	An additional subsidiary hazard label may be required by a Note found adjacent to the technical name entry in Table 2-7.
A151		•	When dry ice is used as a refrigerant for other than dangerous goods loaded in a unit load device, the quantity limits per package shown in columns 11 and 13 of Table 3-1 for dry ice do not apply. In such case, the unit load device must be identified to the operator and must allow the venting of the carbon dioxide gas to prevent a dangerous build-up of pressure.
A152		•	Insulated packaging's conforming to the requirements of Packing Instruction 202 containing refrigerated liquid nitrogen fully absorbed in a porous material are not subject to these Instructions provided the design of the insulated packaging would not allow the build-up of pressure within the container and would not permit the release of any refrigerated liquid nitrogen irrespective of the orientation of the insulated packaging and any outer packaging or overpack used is closed in a way that will not allow the build-up of pressure within that packaging or overpack. When used to contain substances not subject to these Instructions, the words "not restricted" and the special provision number A152 must be provided on the air waybill when an air waybill is issued.
A153		•	Not used.

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≠	**A154**	(≈376)	•	Lithium ion cells or batteries, lithium metal cells or batteries and sodium ion cells or batteries, identified as being defective for safety reasons, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden for transport (such as those being returned to the manufacturer for safety reasons or cells or batteries that cannot be diagnosed as defective prior to transport). • Lithium-ion cells or batteries, lithium metal cells or batteries and sodium ion cells or batteries, identified as being damaged such that they do not conform to the type tested according to the applicable provisions of the UN *Manual of Tests and Criteria* are forbidden for transport. For the purposes of this special provision, these may include, but are not limited to: a) cells or batteries that have leaked or vented; b) cells or batteries that cannot be diagnosed prior to transport; or c) cells or batteries that have sustained physical or mechanical damage. • In assessing a cell or battery as defective or damaged, an assessment or evaluation must be performed based on safety criteria from the cell, battery or product manufacturer or by a technical expert with knowledge of the cells or battery's safety features. An assessment or evaluation may include, but is not limited to, the following criteria: a) acute hazard, such as gas, fire, or electrolyte leaking; b) the use or misuse of the cell or battery; c) signs of physical damage, such as deformation to cell or battery casing, or colours on the casing; d) external and internal short circuit protection, such as voltage or isolation measures; e) the condition of the cell or battery safety features; or f) damage to any internal safety components, such as the battery management system.
	A155	(332)	•	Magnesium nitrate hexahydrate is not subject to these Instructions.
	A156	(333)	•	Ethanol and gasoline, motor spirit or petrol mixtures for use in spark-ignition engines (such as in automobiles, stationary engines and other engines) must be assigned to this entry regardless of variations in volatility.
	A157	(334)	•	A fuel cell cartridge may contain an activator provided it is fitted with two independent means of preventing unintended mixing with the fuel during transport.

A158	(335)	• Mixtures of solids which are not subject to these Instructions and liquids or solids classified by the shipper as environmentally hazardous substances (UN 3077 and 3082) (see Special Provision A97) may be transported under this entry, provided there is no free liquid visible at the time the substance is loaded or at the time the packaging is closed. Sealed packets and articles containing less than 10 mL of an environmentally hazardous liquid, absorbed into a solid material but with no free liquid in the packet or article, or containing less than 10 g of an environmentally hazardous solid, are not subject to these Instructions.
A159	(336)	• A single package of non-combustible solid LSA-II or LSA-III material must not contain an activity greater than 3000 A_2.
A160	(337)	• Type B(U) and Type B(M) packages, must not contain activities greater than the following: a) For low dispersible radioactive material: as authorized for the package design as specified in the certificate of approval; b) For special form radioactive material: 3000 A_1 or 100 000 A_2, whichever is the lower; or c) For all other radioactive material: 3000 A_2.`
A161	(338)	• Each fuel cell cartridge transported under this entry and designed to contain a liquefied flammable gas must: a) be capable of withstanding, without leakage or bursting, a pressure of at least two (2) times the equilibrium pressure of the contents at 55°C; b) not containing more than 200 mL liquefied flammable gas, the vapour pressure of which must not exceed 1 000 kPa at 55°C; and c) pass the hot water bath test prescribed in 6;5.

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A162	(339)	• Fuel cell cartridges containing hydrogen in a metal hydride transported under this entry must have a water capacity less than or equal to 120 mL. • The pressure in the fuel cell cartridge must not exceed 5 MPa at 55°C. The design type must withstand, without leaking or bursting, a pressure of two (2) times the design pressure of the cartridge at 55°C or 200 kPa more than the design pressure of the cartridge at 55°C, whichever is greater. The pressure at which this test is conducted is referred to in the drop test and the hydrogen cycling test as the "minimum shell burst pressure". • Fuel cell cartridges must be filled in accordance with procedures provided by the manufacturer. The manufacturer must provide the following information with each fuel cell cartridge: a) inspection procedures to be carried out before initial filling and before refilling of the fuel cell cartridge; b) safety precautions and potential hazards to be aware of; c) method for determining when the rated capacity has been achieved; d) minimum and maximum pressure range; e) minimum and maximum temperature range; and f) any other requirements to be met for initial filling and refilling including the type of equipment to be used for initial filling and refilling. The fuel cell cartridges must be designed and constructed to prevent fuel leakage under normal conditions of transport. Each cartridge design type, including cartridges integral to a fuel cell, must be subjected to and must pass the following tests: **Drop test** A 1.8 metre drop test onto an unyielding surface in four different orientations: a) vertically, on the end containing the shut-off valve assembly; b) vertically, on the end opposite to the shut-off valve assembly; c) horizontally, onto a steel apex with a diameter of 38 mm, with the steel apex in the upward position; and

			d) at a 45° angle on the end containing the shut-off valve assembly. There must be no leakage, determined by using a soap bubble solution or other equivalent means on all possible leak locations, when the cartridge is charged to its rated charging pressure. The fuel cell cartridge must then be hydrostatically pressurized to destruction. The recorded burst pressure must exceed 85 per cent of the minimum shell burst pressure. **Fire test** A fuel cell cartridge filled to rated capacity with hydrogen must be subjected to a fire engulfment test. The cartridge design, which may include a vent feature integral to it, is deemed to have passed the fire test if: a) the internal pressure vents to zero gauge pressure without rupture of the cartridge; or b) the cartridge withstands the fire for a minimum of 20 minutes without rupture. **Hydrogen cycling test** This test is intended to ensure that a fuel cell cartridge design stress limits are not exceeded during use. The fuel cell cartridge must be cycled from not more than 5 percent rated hydrogen capacity to not less than 95 percent rated hydrogen capacity and back to not more than 5 pepercentated hydrogen capacity. The rated charging pressure must be used for charging and temperatures must be held within the operating temperature range. The cycling must be continued for at least 100 cycles.
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			Following the cycling test, the fuel cell cartridge must be charged, and the water volume displaced by the cartridge must be measured. The cartridge design is deemed to have passed the hydrogen cycling test if the water volume displaced by the cycled cartridge does not exceed the water volume displaced by an uncycled cartridge charged to 95 per cent rated capacity and pressurized to 75 per cent of its minimum shell burst pressure. **Production leak test** Each fuel cell cartridge must be tested for leaks at 15°C ± 5°C, while pressurized to its rated charging pressure. There must be no leakage, determined by using a soap bubble solution or other equivalent means on all possible leak locations. Each fuel cell cartridge must be permanently marked with the following information: a) the rated charging pressure in megapascals (MPa); b) the manufacturer's serial number of the fuel cell cartridges or unique identification number; and c) the date of expiry based on the maximum service life (year in four digits; month in two digits).
	A163	(340)	• Chemical kits, first-aid kits and polyester resin kits containing dangerous goods in inner packaging's which do not exceed the quantity limits for excepted quantities applicable to individual substances as specified in column 9 of Table 3-1 may be transported in accordance with 3;5. Division 5.2 substances, although not individually permitted as excepted quantities in Table 3-1, are permitted in such kits and are assigned Code E2 (see 5.1.2).
≠	**A164**		• Not used.
	A165	(347)	• This entry may only be used if the results of Test Series 6 (d) of Part I of the UN *Manual of Tests and Criteria* have demonstrated that any hazardous effects arising from functioning are confined within the package.
	A166	(343)	• This entry applies to crude oil containing hydrogen sulphide in sufficient concentration that vapours evolved from the crude oil can present an inhalation hazard. The packing group assigned must be determined by the flammability hazard and inhalation hazard, in accordance with the degree of danger presented.
	A167	(344)	• The provisions of 6;5 must be met.
	A168	(348)	• Not used. *Note. — See Packing Instructions 965 to 967.*

A169	(349)	• Mixtures of a hypochlorite with an ammonium salt are not to be accepted for transport. UN 1791 **Hypochlorite solution** is a substance of Class 8.
A170	(350)	• Ammonium bromate and its aqueous solutions and mixtures of a bromate with an ammonium salt are forbidden for transport.
A171	(351)	• Ammonium chlorate and its aqueous solutions and mixtures of a chlorate with an ammonium salt are forbidden for transport.
A172	(352)	• Ammonium chlorite and its aqueous solutions and mixtures of a chlorite with an ammonium salt are forbidden for transport.
A173	(353)	• Ammonium permanganate and its aqueous solutions and mixtures of a permanganate with an ammonium salt are forbidden for transport.
A174	(354)	• Not used.
A175	(355)	• Oxygen cylinders for emergency use transported under this entry may include installed actuating cartridges (cartridges, power device of Division 1.4, Compatibility Group C or S), without changing the classification of Division 2.2 provided the total quantity of deflagrating (propellant) explosives does not exceed 3.2 g per oxygen cylinder. The cylinders with the installed actuating cartridges as prepared for transport must have an effective means of preventing inadvertent activation.

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A176	(356)	• Metal hydride storage systems installed in vehicles, vessels, machinery, engines or aircraft or in completed components or intended to be installed in vehicles, vessels, machinery, engines or aircraft must be approved by the appropriate national authority before acceptance for transport. Transport in accordance with this special provision must be noted on the dangerous goods transport document. The dangerous goods transport document must include an indication that the package was approved by the appropriate national authority or a copy of the appropriate national authority approval must accompany each consignment.
A177	(357)	• Petroleum crude oil containing hydrogen sulphide in sufficient concentration that vapours evolved from the crude oil can present an inhalation hazard must be consigned under the entry UN 3494 **Petroleum sour crude oil, flammable, toxic**.
A178		• Security type equipment such as attaché cases, cash boxes, cash bags, etc., incorporating dangerous goods, for example lithium batteries, gas cartridges and/or pyrotechnic material, are not subject to these Instructions if the equipment complies with the following: a) The equipment must be equipped with an effective means of preventing accidental activation; b) If the equipment contains an explosive or pyrotechnic substance or an explosive article, this article or substance must be excluded from Class 1 by the appropriate national authority of the State of Manufacture in compliance with Part 2;1.5.2.1; c) If the equipment contains lithium cells or batteries, these cells or batteries must comply with the following restrictions: 1) for a lithium metal cell, the lithium content is not more than 1 g; 2) for a lithium metal or lithium alloy battery, the aggregate lithium content is not more than 2 g; 3) for lithium-ion cells, the Watt-hour rating (see Attachment 2) is not more than 20 Wh; 4) for lithium-ion batteries, the Watt-hour rating is not more than 100 Wh; 5) Each cell or battery is of the type proven to meet the requirements of each test in the UN *Manual of Tests and Criteria*, Part III, section 38.3; d) If the equipment contains gases to expel dye or ink, only gas cartridges and receptacles, small, containing gas with a capacity not exceeding 50 mL, containing no constituents subject to these Instructions other than a Division 2.2 gas, are allowed. The release of gas must not cause extreme annoyance or discomfort to crew members to prevent the correct performance of assigned duties. In case of accidental activation, all hazardous effects must be confined within the equipment and must not produce extreme noise.

	e) Security type equipment that is defective or that has been damaged is forbidden for transport. The words “not restricted” and the special provision number A178 must be provided on the air waybill when an air waybill is issued.
A179	• For UN 3077, irrespective of the maximum net quantities specified in columns 11 and 13 of Table 3-1, intermediate bulk containers (IBCs) with a maximum net quantity not exceeding 1 000 kg are permitted in accordance with Packing Instruction 956.

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A180		• Non-infectious specimens, such as specimens of mammals, birds, amphibians, reptiles, fish, insects and other invertebrates containing small quantities of **UN 1170, UN 1198, UN 1987 or UN 1219** are not subject to these Instructions provided the following packing and marking requirements are met: a) specimens are: 1) wrapped in paper towel and/or cheesecloth moistened with alcohol, an alcohol solution or a formaldehyde solution and then placed in a plastic bag that is heat-sealed. Any free liquid in the bag must not exceed 30 mL; or 2) placed in vials or other rigid containers with no more than 30 mL of alcohol, an alcohol solution or a formaldehyde solution; b) the prepared specimens are then placed in a plastic bag that is then heat-sealed; c) the bagged specimens are then placed inside another plastic bag with absorbent material then heat-sealed; d) the finished bag is then placed in a strong outer packaging with suitable cushioning material; e) the total quantity of flammable liquid per outer packaging must not exceed 1 L; and f) the completed package is marked “scientific research specimens, not restricted Special Provision A180 applies”. The words “not restricted” and the special provision number A180 must be provided on the air waybill when an air waybill is issued.
A181		• When a package contains a combination of lithium batteries contained in equipment and lithium batteries packed with equipment, the following requirements apply: a) the shipper must ensure that all applicable parts of both packing instructions are met. The total mass of lithium batteries contained in any package must not exceed the limits for passenger aircraft or cargo aircraft, as applicable; b) the package must be marked UN 3091 **Lithium metal batteries packed with equipment**, or UN 3481 **Lithium-ion batteries packed with equipment**, as appropriate. If a package contains both lithium metal batteries and lithium-ion batteries packed with and contained in equipment, the package must be marked as required for both battery types. However, button cell batteries installed in equipment (including circuit boards) need not be considered; c) the dangerous goods transport document must include the wording “UN 3091 **Lithium metal batteries packed with equipment**” or “UN 3481 **Lithium-ion batteries packed with equipment**”, as appropriate. If a package contains both lithium metal batteries and lithium-ion batteries packed with and contained in equipment, then the dangerous goods transport document must include the wording “UN 3091 **Lithium metal batteries packed with equipment**” and “UN 3481 **Lithium-ion batteries packed with equipment**”.
A182		• Equipment containing only lithium batteries must be classified as either UN 3091 or UN 3481.
A183		• Waste cells and batteries and cells or batteries being shipped for recycling or disposal are forbidden from air transport unless approved by the appropriate national authority of the State of Origin and the State of the Operator.
A184	(304)	• This entry may only be used for the transport of non-activated batteries which contain dry potassium hydroxide and which are intended to be activated prior to use by the addition of an appropriate amount of water to the individual cells.

A185	(360)	• Vehicles only powered by lithium metal, lithium ion or sodium ion batteries must be assigned to UN 3556 **Vehicle, lithium ion battery powered** or UN 3557 **Vehicle, lithium metal battery powered** or UN 3558 **Vehicle, sodium ion battery powered**, as applicable. • Lithium batteries installed in cargo transport units, designed only to provide power external to the transport unit must be assigned to UN 3536 **Lithium batteries installed in cargo transport unit**.

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A186	(361)	• This entry applies to electric double layer capacitors with an energy storage capacity greater than 0.3 Wh. Capacitors with an energy storage capacity of 0.3 Wh or less are not subject to these Instructions. Energy storage capacity means the energy held by a capacitor, as calculated using the nominal voltage and capacitance. All capacitors to which this entry applies, including capacitors containing an electrolyte that does not meet the classification criteria of any class or division of dangerous goods, must meet the following conditions: a) capacitors not installed in equipment must be transported in an uncharged state. Capacitors installed in equipment must be transported either in an uncharged state or protected against a short circuit; b) each capacitor must be protected against a potential short circuit hazard in transport as follows: i) when a capacitor's energy storage capacity is less than or equal to 10 Wh or when the energy storage capacity of each capacitor in a module is less than or equal to 10 Wh, the capacitor or module must be protected against a short circuit or be fitted with a metal strap connecting the terminals; and ii) when the energy storage capacity of a capacitor or a capacitor in a module is more than 10 Wh, the capacitor or module must be fitted with a metal strap connecting the terminals; c) capacitors containing dangerous goods must be designed to withstand a 95 kPa pressure differential; d) capacitors must be designed and constructed to safely relieve pressure that may build up in use, through a vent or a weak point in the capacitor casing. Any liquid which is released upon venting must be contained by the packaging or by the equipment in which a capacitor is installed; and e) capacitors manufactured after 31 December 2013 must be marked with the energy storage capacity in Wh. **Capacitors** containing an electrolyte not meeting the classification criteria of any class or division of dangerous goods, including when installed in equipment, are not subject to other provisions of these Instructions. **Capacitors** containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, with an energy storage capacity of 10 Wh or less are not subject to other provisions of these Instructions when they are capable of withstanding a 1.2 metre drop test unpackaged on an unyielding surface without loss of contents. **Capacitors** containing an electrolyte meeting the classification criteria of any class or division of dangerous goods that are not installed in equipment and with an energy storage capacity of more than 10 Wh are subject to these Instructions. **Capacitors** installed in equipment and containing an electrolyte meeting the classification criteria of any class or division of dangerous goods are not subject to other provisions of these Instructions provided the equipment is packaged in a strong outer packaging constructed of suitable material and of adequate strength and design in relation to the packaging's intended use and in such a manner as to prevent accidental functioning of capacitors during transport. Large robust equipment containing capacitors may be offered for transport unpackaged or on pallets when capacitors are afforded equivalent protection by the equipment in which they are contained. *Note. — Capacitors which by design maintain a terminal voltage (such as asymmetrical capacitors) do not belong to this entry.*

A187	(362)	• This entry applies to liquids, pastes or powders, pressurized with a propellant which meets the definition of a gas in 2;2.1.1 and 2;2.1.2 a) or b). *Note. — A chemical under pressure in an aerosol dispenser must be transported under UN 1950.* The following provisions must apply: a) The chemical under pressure must be classified based on the hazard characteristics of the components in the different states: i) the propellant; ii) the liquid; or iii) the solid.

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		If one of these components, which can be a pure substance or a mixture, needs to be classified as flammable, the chemical under pressure must be classified as flammable in Division 2.1. Flammable components are flammable liquids and liquid mixtures, flammable solids and solid mixtures or flammable gases and gas mixtures meeting the following criteria: i) a flammable liquid is a liquid having a flashpoint of not more than 93°C; ii) a flammable solid is a solid which meets the criteria in 2;4.2.2 of these Instructions; iii) a flammable gas is a gas which meets the criteria in 2;2.2.1 of these Instructions; b) gases of Division 2.3 and gases with a subsidiary hazard of 5.1 must not be used as a propellant in a chemical under pressure; c) where the liquid or solid components are classified as dangerous goods of Division 6.1, Packing Groups II or III, or Class 8, Packing Groups II or III, the chemical under pressure must be assigned a subsidiary hazard of Division 6.1 or Class 8 and the appropriate UN number must be assigned. Components classified in Division 6.1, Packing Group I, or Class 8, Packing Group I, must not be used for transport under this proper shipping name; d) in addition, chemicals under pressure with components meeting the properties of: Class 1, explosives; Class 3, liquid desensitized explosives; Division 4.1, self-reactive substances and solid desensitized explosives; Division 4.2, substances liable to spontaneous combustion; Division 4.3, substances which, in contact with water, emit flammable gases; Division 5.1, oxidizing substances; Division 5.2, organic peroxides; Division 6.2, infectious substances; or Class 7, radioactive material, must not be used for transport under this proper shipping name; e) Chemicals under pressure containing components forbidden for transport on both passenger and cargo aircraft (columns 10 to 13 of Table 3-1) must not be transported by air.
A188	(359)	• Nitroglycerin solution in alcohol with more than 1 per cent but not more than 5 per cent nitroglycerin must be classified in Class 1 and assigned to **UN 0144** if not all the requirements of Packing Instruction 371 are complied with.
A189		• Except where the defining criteria of another class or division are met, concentrations of formaldehyde solution: — with less than 25 per cent but not less than 10 per cent formaldehyde must be classified as **UN 3334 Aviation regulated liquid, n.o.s.**; and — with less than 10 per cent formaldehyde are not subject to these Instructions.

≠	**A190**	(373)	• Neutron radiation detectors containing non-pressurized boron trifluoride gas may be transported under this entry provided that: a) radiation detectors containing more than 1 g of boron trifluoride and radiation detection systems containing neutron radiation detectors as components may be transported on cargo aircraft in accordance with all applicable requirements of these Instructions irrespective of the indication of "forbidden" in columns 12 and 13 of Table 3-1, provided the following conditions are met: i) each radiation detector must meet the following conditions: 1) the pressure in each neutron radiation detector must not exceed 105 kPa absolute at 20°C; 2) the amount of gas must not exceed 13 g per detector; 3) each detector must be manufactured under a registered quality assurance programme; *Note.— The application of ISO 9001:2008 may be considered acceptable for this purpose.* 4) each neutron radiation detector must be of welded metal construction with brazed metal to ceramic feed through assemblies. These detectors must have a minimum burst pressure of 1 800 kPa as demonstrated by design type qualification testing; and 5) each detector must be tested to a 1 x 10^{-10} cm^3/s leaktightness standard before filling.

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		ii) radiation detectors transported as individual components must be transported as follows: 1) they must be packed in a sealed intermediate plastic liner with sufficient absorbent or adsorbent material to absorb or absorb the entire gas contents; 2) they must be packed in strong outer packaging's and the completed package must be capable of withstanding a 1.8 m drop test without leakage of gas contents from detectors; and 3) the total amount of gas from all detectors per outer packaging must not exceed 52 g. iii) completed neutron radiation detector systems containing detectors meeting the conditions of sub-paragraph i) must be transported as follows: 1) the detectors must be contained in a strong sealed outer casing; 2) the casing must contain sufficient absorbent or adsorbent material to absorb or adsorb the entire gas contents; and 3) the completed system must be packed in strong outer packaging's capable of withstanding a 1.8 m drop test without leakage unless the system's outer casing affords equivalent protection. iv) each package must bear a "toxic gas" and "corrosive" hazard label irrespective of no labels being indicated in column 5; v) transport in accordance with this special provision must be noted on the dangerous goods transport document. A packing instruction must not be shown on the transport document. If the above conditions are met, the requirements of Special Provision A2 do not apply. b) neutron radiation detectors containing not more than 1 g of boron trifluoride, including those with solder glass joints, and radiation detection systems containing such detectors are not subject to these Instructions when carried as cargo, provided the following conditions are met: i) each radiation detector must meet the requirements in sub-paragraph a) i) and be packed in accordance with sub-paragraph a) ii); ii) radiation detection systems containing such detectors must be packed in accordance with sub-paragraph a) iii); and iii) the words "not restricted" and the special provision number A190 must be provided on the air waybill when an air waybill is used. If the above conditions are met, the requirements of Special Provision A2 do not apply.

A191		• Notwithstanding the Division 6.1 subsidiary hazard shown in column 4 of Table 3-1, the toxic subsidiary hazard label and an indication of this subsidiary hazard on the dangerous goods transport document are not required when the manufactured articles contain not more than 5 kg of mercury. Transport in accordance with this special provision must be noted on the dangerous goods transport document.
A192	(367)	• For the purposes of documentation and package marking: — the proper shipping name **Paint related material** may be used for consignments of packages containing paint and paint related material in the same package; — the proper shipping name **Paint related material, corrosive, flammable** may be used for consignments of packages containing paint, corrosive, flammable and paint related material, corrosive, flammable in the same package; — the proper shipping name **Paint related material, flammable, corrosive** may be used for consignments of packages containing paint, flammable, corrosive and paint related material, flammable, corrosive in the same package; and — the proper shipping name **Printing ink related material** may be used for consignments of packages containing printing ink and printing ink related material in the same package.
A193	(368)	• In the case of non-fissile or fissile-excepted uranium hexafluoride, the material must be classified under UN 3507 or UN 2978.

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	A194	(369)	• In accordance with Part 2, Introductory Chapter, paragraph 4, this radioactive material in an excepted package possessing toxic and corrosive properties is classified in Division 6.1 with radioactive and corrosive subsidiary hazards. Uranium hexafluoride may be classified under this entry only if the conditions of: 2;7.2.4.1.1.2, 2;7.2.4.1.1.5, 2;7.2.4.5.2 2;7.2.3.6 fissile-excepted material, are met. In addition to the provisions applicable to the transport of Division 6.1 substances with a corrosive subsidiary hazard, the provisions contained in Segment 5 and 7 apply. No Class 7 label is required to be displayed.
≠	**A195**	(371)	• This entry also applies to articles containing a small pressure receptacle with a release device. Such articles must comply with the following requirements: a) the water capacity of the pressure receptacle must not exceed 0.5 litres and the working pressure must not exceed 25 bar at 15°C; b) the minimum burst pressure of the pressure receptacle must be at least four times the pressure of the gas at 15°C; c) each article must be manufactured in such a way that unintentional firing or release is avoided under normal conditions of handling, packing, transport and use. This may be achieved by an additional locking device linked to the activator; d) each article must be manufactured in such a way as to prevent hazardous projections of the pressure receptacle or parts of the pressure receptacle; e) each pressure receptacle must be manufactured from material which will not fragment upon rupture;

		f) the design type of the article must be subjected to a fire test. For this test, the provisions of paragraphs 16.6.1.2, except sub-paragraph g), 16.6.1.3.1 to 16.6.1.3.1.4, 16.6.1.3.6, 16.6.1.3.7 b) and 16.6.1.3.8 of the UN *Manual of Tests and Criteria* must be applied. It must be demonstrated that the article relieves its pressure by means of a fire degradable seal or other pressure relief device, in such a way that the pressure receptacle will not fragment and that the article or fragments of the article do not rocket more than 10 metres; and g) the design type of the article must be subjected to the following test. A stimulating mechanism must be used to initiate one article in the middle of the packaging. There must be no hazardous effects outside the package such as disruption of the package, metal fragments or a receptacle which passes through the packaging. 2) The manufacturer must produce technical documentation of the design type, manufacture as well as the tests and their results. The manufacturer must apply procedures to ensure that articles produced in a series are made of good quality, conform to the design type and are able to meet the requirements in 1). The manufacturer must provide such information to the appropriate national authority on request.
A196	(372)	• This entry applies to asymmetric capacitors with an energy storage capacity greater than 0.3 Wh. Capacitors with an energy storage capacity of 0.3 Wh or less are not subject to these Instructions. Energy storage capacity means the energy stored in a capacitor, as calculated according to the following equation: $Wh = 1/2C_N(U_R^2 - U_L^2) \times (1/3600)$, using the nominal capacitance (C_N), rated voltage (U_R) and rated lower limit voltage (U_L). All asymmetric capacitors to which this entry applies must meet the following conditions: a) capacitors or modules must be protected against short circuits; b) capacitors must be designed and constructed to safely relieve pressure that may build up in use, through a vent or a weak point in the capacitor casing. Any liquid which is released upon venting must be contained by packaging or by equipment in which a capacitor is installed;

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		c) capacitors manufactured after 31 December 2015 must be marked with the energy storage capacity in Wh; and d) capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods must be designed to withstand a 95 kPa pressure differential. **Capacitors** containing an electrolyte not meeting the classification criteria of any class or division of dangerous goods, including when configured in a module or when installed in equipment, are not subject to other provisions of these Instructions. **Capacitors** containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, with an energy storage capacity of 20 Wh or less, including when configured in a module, are not subject to other provisions of these Instructions when the capacitors are capable of withstanding a 1.2 m drop test unpackaged on an unyielding surface without loss of contents. **Capacitors** containing an electrolyte meeting the classification criteria of any class or division of dangerous goods that are not installed in equipment and with an energy storage capacity of more than 20 Wh are subject to these Instructions. **Capacitors** installed in equipment and containing an electrolyte meeting the classification criteria of any class or division of dangerous goods are not subject to other provisions of these Instructions provided that the equipment is packaged in a strong outer packaging constructed of suitable material, and of adequate strength and design, in relation to the packaging's intended use and in such a manner as to prevent accidental functioning of capacitors during transport. Large robust equipment containing capacitors may be offered for transport unpackaged or on pallets when capacitors are afforded equivalent protection by the equipment in which they are contained. *Note. — Notwithstanding the provisions of this special provision, nickel-carbon asymmetric capacitors containing Class 8 alkaline electrolytes must be transported as UN 2795,* ***Batteries, wet, filled with alkali****, electric storage.*

	A197 (375)	• These substances when transported in single or combination packaging's containing a net quantity per single or inner packaging of 5 L or less for liquids or having a net mass per single or inner packaging of 5 kg or less for solids, are not subject to any other provisions of these Instructions provided the packaging's meet the general provisions of Segment 4.
	A198	• Hay, straw and bhusa, when not wet, damp or contaminated with oil are not subject to these Instructions.
≠	**A199**	• Nickel-metal hydride batteries or nickel-metal hydride battery-powered devices, equipment or vehicles are not subject to these Instructions provided they are prepared for transport so as to prevent: a) a short circuit (such as in the case of batteries, by the effective insulation of exposed terminals, or, in the case of equipment, by disconnection of the battery and protection of exposed terminals); and b) unintentional activation. • The words "not restricted" and the special provision number A199 must be provided on the air waybill when an air waybill is issued. • Devices such as RFID tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.
	A200	• This entry applies to packaging's that contain residues of dangerous goods and which no longer meet the provisions of Part 6. These packaging's are forbidden for transport by air. Such packagings or parts thereof must be transported in accordance with Segment 4 of these Instructions.
≠	**A201**	• In instances where other forms of transport (including cargo aircraft) are impracticable, lithium and sodium ion cells or batteries may be transported as Class 9 (UN 3480, UN 3090 or UN 3551) on passenger aircraft with the prior approval of the authority of the State of Origin, the State of the Operator and the State of Destination under the written conditions established by those authorities, provided that the quantities per package do not exceed: a) for lithium metal cells or batteries: 1) up to 2 batteries with a lithium content more than 0.3 g but not more than 2 g per battery; or

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		2) up to 8 cells with a lithium content more than 0.3 g but not more than 1 g per cell; or 3) up to 2.5 kg of cells and/or batteries with a lithium content not more than 0.3 g per cell or battery; or b) for lithium ion cells or batteries: 1) up to 2 batteries with a Watt-hour (Wh) rating more than 2.7 Wh but not more than 100 Wh per battery; or 2) up to 8 cells with a Watt-hour rating more than 2.7 Wh but not more than 20 Wh per cell; or 3) up to 2.5 kg of cells and/or batteries with a Watt-hour rating not more than 2.7 Wh per cell or battery; or c) for sodium ion cells or batteries: 1) up to 2 batteries with a Watt-hour (Wh) rating more than 2.7 Wh but not more than 100 Wh per battery; or 2) up to 8 cells with a Watt-hour rating more than 2.7 Wh but not more than 20 Wh per cell; or 3) up to 2.5 kg of cells and/or batteries with a Watt-hour rating not more than 2.7 Wh per cell or battery.

In instances where other forms of transport (including cargo aircraft) are impracticable and in the case of urgent medical need, one consignment of lithium batteries may be transported as Class 9 (UN 3480 or UN 3090) on a passenger aircraft with the prior approval of the authority of the State of Origin and with the approval of the operator under the following conditions:

a) the shipper must provide a copy of the test summary report as specified in Segment 2);

b) the consignment must not contain more than 4 batteries;

c) for lithium ion batteries:

1) the Watt-hour rating of each battery must not exceed 100 Wh; and

2) the batteries must be prepared in accordance with Packing Instruction 965, Section IA;

d) for lithium metal batteries:

1) the lithium content of each battery must not exceed 2 g; and

2) the batteries must be prepared in accordance with Packing Instruction 968, Section IA.

When States, other than the State of Origin, the State of the Operator or State of Destination have notified ICAO that they require prior approval of shipments made under this special provision, approval must also be obtained from these States, as appropriate.

The requirements of Part 5 for Class 9 (UN 3090 or UN 3480) lithium metal and lithium-ion batteries apply. A copy of the document of approval including the quantity limitations must accompany the consignment. Transport in accordance with this special provision must be noted on the dangerous goods transport document.

If transport in accordance with this special provision is not possible, States concerned may grant an exemption from the prohibition to transport lithium metal or lithium-ion batteries on passenger aircraft in accordance with Segment 1.

TIs	*UN*	
A202	(≈378)	• Radiation detectors containing this gas in non-refillable cylinders which do not meet the requirements of Part 6;5 and Packing Instruction 200 may be offered for transport under this entry provided: a) the working pressure in each cylinder does not exceed 50 bar; b) the cylinder capacity does not exceed 12 L; c) each cylinder has a minimum burst pressure of at least three times the working pressure when a relief device is fitted and at least four times the working pressure when no relief device is fitted; d) each cylinder is manufactured from material which will not fragment upon rupture; e) each detector is manufactured under a registered quality assurance programme; *Note. — ISO 9001:2008 may be used for this purpose.*

		f) detectors are transported in strong outer packaging's. The complete package must be capable of withstanding a 1.2 m drop test without breakage of the detector or rupture of the outer packaging. Equipment that includes a detector must be packed in a strong outer packaging unless the detector is afforded equivalent protection by the equipment in which it is contained; and g) transport in accordance with this special provision must be noted on the dangerous goods transport document. Radiation detectors, including detectors in radiation detection systems, are not subject to any other requirements of these Instructions if the detectors meet the requirements in a) to f) above and the capacity of detector cylinders does not exceed 50 mL.
A203	(380)	• Not used.
A204	(382)	• Polymeric beads may be made from polystyrene, poly (methyl methacrylate) or other polymeric material. When it can be demonstrated that no flammable vapour, resulting in a flammable atmosphere, is evolved according to test U1 (Test method for substances liable to evolve flammable vapours) of Part III, sub-section 38.4.4 of the UN *Manual of Tests and Criteria*, polymeric beads, expandable need not be classified under this UN number. This test should only be performed when de-classification of a substance is considered.
A205	(383)	• Table tennis balls manufactured from celluloid are not subject to these Instructions where the net mass of each table tennis ball does not exceed 3.0 g and the total net mass of table tennis balls does not exceed 500 g per package.
A206		• Not used.
A207	(≈385)	• Not used.
A208	(≈363)	• a) This entry applies to engines or machinery, powered by fuels classified as dangerous goods via internal combustion systems or fuel cells (such as combustion engines, generators, compressors, turbines, heating units).

TIs	*UN*	
		b) Engines and machinery containing fuels meeting the classification criteria of Class 3 must be consigned under the entries UN 3528 – **Engine, internal combustion, flammable liquid powered** or UN 3528 – **Engine, fuel cell, flammable liquid powered** or UN 3528 – **Machinery, internal combustion, flammable liquid powered** or UN 3528 – **Machinery, fuel cell, flammable liquid powered**, as appropriate. c) Engines and machinery containing fuels meeting the classification criteria of Division 2.1 must be consigned under the entries UN 3529 – **Engine, internal combustion, flammable gas powered** or UN 3529 – **Engine, fuel cell, flammable gas powered** or UN 3529 – **Machinery, internal combustion, flammable gas powered** or UN 3529 – **Machinery, fuel cell, flammable gas powered**, as appropriate. Engines and machinery powered by both a flammable gas and a flammable liquid must be consigned under the appropriate UN 3529 entry. d) Engines and machinery containing liquid fuels meeting the classification criteria for environmentally hazardous substances and not meeting the classification criteria of any other class or division, must be consigned under the entries UN 3530 – **Engine, internal combustion** or UN 3530 – **Machinery, internal combustion**, as appropriate.
A209	(≈386)	• When chemical stabilization is employed, the person offering the packaging for transport must ensure that the level of stabilization is sufficient to prevent the substance in the packaging from dangerous polymerization at a bulk mean temperature of 50°C. Where chemical stabilization becomes ineffective at lower temperatures within the anticipated duration of transport, temperature control is required in which case the substances are forbidden for transport by air.
A210		• This substance is forbidden for transport by air. It may be transported on cargo aircraft only with the prior approval of the appropriate authority of the State of Origin and the State of the Operator under the written conditions established by those authorities.

A211		• Receptacles, small containing gas (toxic, oxidizing and corrosive) or Gas cartridges (toxic, oxidizing and corrosive) which are intended for use in sterilization devices only, when containing: a) UN1067 — **Nitrogen dioxide**; or b) UN1660 — **Nitric oxide, compressed** may be transported on passenger and cargo aircraft irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided: a) the water capacity of receptacles or gas cartridges does not exceed 30 mL; b) receptacles or gas cartridges are designed such that the burst pressure is not less than four times the pressure in the cartridge at 55°C; c) receptacles or gas cartridges are packed in a compatible, sealed intermediate packaging with sufficient adsorbent material capable of containing the contents of the gas cartridge; d) intermediate packaging's are securely packed in an outer packaging of a type permitted by Packing Instruction 203 meeting the Packing Group I performance requirements of Part 6; Chapter 1; e) the aggregate water capacity of all receptacles or gas cartridges in a package does not exceed 300 mL; f) packages bear hazard labels denoting the hazards of "toxic gas", "oxidizer" and "corrosive"; and g) reference to Special Provision A211 is made on the dangerous goods transport document as required by Part 5;4.1.5.8. If the above conditions are met, the requirements of Special Provision A2 do not apply.
A212		• UN 2031 — **Nitric acid**, other than red fuming, with more than 20% and less than 65% nitric acid intended for use in sterilization devices only, may be transported on passenger aircraft irrespective of the indication of "forbidden" in columns 10 and 11 of Table 3-1 provided: a) each inner packaging contains not more than 30 mL;
TIs	*UN*	
		b) each inner packaging is contained in a sealed leak-proof intermediate packaging with sufficient absorbent material capable of containing contents of the inner packaging; c) intermediate packaging's are securely packed in an outer packaging of a type permitted by Packing Instruction 855 meeting the Packing Group I performance requirements of Part 6; Chapter 1; d) the maximum quantity of nitric acid in the package does not exceed 300 mL; and e) reference to Special Provision A212 is made on the dangerous goods transport document as required by Part 5;4.1.5.8.
A213	(387)	• Lithium batteries in conformity with 2;9.3 f) containing both primary lithium metal cells and rechargeable lithium-ion cells must be assigned to UN Nos. 3090 or 3091 as appropriate. When such batteries are transported in accordance with Section IB of Packing Instruction 968 or in accordance with Section II of Packing Instruction 969 or 970, the total lithium content of all lithium metal cells contained in the battery must not exceed 1.5 g, and the total capacity of all lithium ion cells contained in the battery must not exceed 10 Wh.
≠ **A214**	(388)	• UN No. 3166 entries apply to vehicles powered by flammable liquid or flammable gas internal combustion engines or fuel cells. • Vehicles powered by a fuel cell engine must be assigned to UN 3166 **Vehicle, fuel cell, flammable gas powered** or UN 3166 **Vehicle, fuel cell, flammable liquid powered**, as appropriate. These entries include hybrid electric vehicles powered by both a fuel cell and an internal combustion engine with wet batteries, sodium batteries, lithium metal batteries or lithium ion batteries, transported with the battery(ies) installed. • Other vehicles which contain an internal combustion engine must be assigned to UN 3166 **Vehicle, flammable gas powered** or UN 3166 **Vehicle, flammable liquid powered**, as appropriate. These entries include hybrid electric vehicles powered by both an internal combustion engine and wet batteries, sodium batteries, lithium metal batteries or lithium ion batteries, transported with the battery(ies) installed.

		• If a vehicle is powered by a flammable liquid and a flammable gas internal combustion engine, it must be assigned to UN 3166 **Vehicle, flammable gas powered**. • Entry UN 3171 only applies to vehicles and equipment powered by wet batteries, metallic sodium batteries or sodium alloy batteries transported with these batteries installed. • UN 3556 **Vehicle, lithium ion battery powered**, UN 3557 **Vehicle, lithium metal battery powered** and UN 3558 **Vehicle, sodium ion battery powered**, as applicable, apply to vehicles powered by lithium ion, lithium metal or sodium ion batteries transported with the batteries installed. • For the purpose of this special provision, vehicles are self-propelled apparatus designed to carry one or more persons or goods. Examples of such vehicles are cars, motorcycles, scooters, three- and four-wheeled vehicles or motorcycles, trucks, locomotives, bicycles (pedal cycles with a motor) and other vehicles of this type (such as self-balancing vehicles or vehicles not equipped with at least one seating position), wheelchairs, lawn tractors, self-propelled farming and construction equipment, boats and aircraft. When vehicles are transported in a packaging, some parts of the vehicle, other than the battery, may be detached from their frame to fit into the packaging. • Examples of equipment are lawnmowers, cleaning machines or model boats and model aircraft. Equipment powered by lithium metal batteries or lithium ion batteries must be assigned to UN 3091 **Lithium metal batteries contained in equipment** or UN 3091 **Lithium metal batteries packed with equipment** or UN 3481 **Lithium ion batteries contained in equipment** or UN 3481 **Lithium ion batteries packed with equipment**, as appropriate. Lithium ion batteries or lithium metal batteries installed in a cargo transport unit and designed only to provide power external to the cargo transport unit must be assigned to UN 3536 **Lithium batteries installed in cargo transport unit**.
A215	(≈274)	• For UN 3077 and UN 3082, the technical name may be a name shown in bold characters in column 1 of Table 3-1, provided that this name does not include "n.o.s." or an "*". The name which most appropriately describes the substance or mixture must be used, such as: UN 3082, **Environmentally hazardous substance, liquid, n.o.s. (Paint)** UN 3082, **Environmentally hazardous substance, liquid, n.o.s. (Perfumery products)**
A216	(393)	• The nitrocellulose must meet the criteria of the Bergmann-Junk test or methyl violet paper test in the UN *Manual of Tests and Criteria* Appendix 10. Tests of type 3 (c) need not be applied.
A217	(394)	• The nitrocellulose must meet the criteria of the Bergmann-Junk test or methyl violet paper test in the UN *Manual of Tests and Criteria* Appendix 10.

TIs	*UN*	
A218	(395)	• This entry must only be used for solid medical waste of Category A transported for disposal.
A219	(308)	• Stabilization of fish meal must be achieved to prevent spontaneous combustion by effective application of ethoxyquin, BHT (butylated hydroxytoluene) or tocopherols (also used in a blend with rosemary extract) at the time of production. The said application must occur within twelve months prior to shipment. Fish meal must contain at least 50 ppm (mg/kg) of ethoxyquin, 100 ppm (mg/kg) of BHT or 250 ppm (mg/kg) of tocopherol-based antioxidant at the time of consignment.
A220		• Packages containing COVID-19 pharmaceuticals accompanied by data loggers and/or cargo tracking devices containing lithium batteries are not subject to the marking and documentation requirements of Section II of Packing Instruction 967 or 970, as applicable. This same package configuration, when consigned without the COVID-19 pharmaceutical for the purpose of use or reuse, is also not subject to the marking and documentation requirements of Section II of Packing Instruction 967 or 970, as applicable, provided prior arrangements have been made with the operator.
A221	(397)	• Mixtures of nitrogen and oxygen containing not less than 19.5 per cent and not more than 23.5 per cent oxygen by volume may be transported under this entry when no other oxidizing gases are present. A Division 5.1 subsidiary hazard label is not required for any concentrations within this limit.
A222	(398)	• This entry applies to mixtures of butylenes, 1-butylene, cis-2-butylene and trans-2-butylene. For isobutylene, see UN 1055.
A223	(≈296)	• Life-saving appliances packed in strong rigid outer packagings with a total maximum gross mass not exceeding 40 kg, containing no dangerous goods other than Division 2.2 compressed or liquefied gases (with no subsidiary hazard) contained in receptacles with a capacity not exceeding 120 mL and installed solely for the purpose of the activation of the appliance, are not subject to these Instructions when carried as cargo.

	A224		• UN 3548 – **Articles containing miscellaneous dangerous goods, n.o.s.** may be transported on passenger and cargo aircraft irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided that: a) with the exception of lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable, the only dangerous goods contained in the article is an environmentally hazardous substance; b) the articles are packed in accordance with Packing Instruction 975; and c) reference to Special Provision A224 is made on the dangerous goods transport document as required by Part 5;4.1.5.8. All other provisions of these Instructions apply. If the above conditions are met, the requirements of Special Provision A2 do not apply.
	A225		• UN 3538 – **Articles containing non-flammable, non-toxic gas, n.o.s.** may be transported on passenger and cargo aircraft irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided that: a) with the exception of lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable, the only dangerous goods contained in the article is a Division 2.2 gas without a subsidiary hazard, but excluding refrigerated liquefied gases and gases forbidden for transport on passenger aircraft; b) the articles are packed in accordance with Packing Instruction 222; and c) reference to Special Provision A225 is made on the dangerous goods transport document as required by Part 5;4.1.5.8. All other provisions of these Instructions apply. If the above conditions are met, the requirements of Special Provision A2 do not apply.
+	**A226**	(399)	• For articles that meet the definition for **Detonators, electronic** as described in Attachment 2 and assigned to UN Nos. 0511, 0512 and 0513, the entries for **Detonators, electric** (UN Nos. 0030, 0255 and 0456) may continue to be used until 30 June 2025.
+	**A228**	(401)	• Sodium ion cells and batteries with organic electrolyte must be transported as UN 3551 or UN 3552 as appropriate. Sodium ion batteries with aqueous alkali electrolyte must be transported as UN 2795 **Batteries, wet, filled with alkali**, electric storage.
+	**A229**	(402)	• Substances transported under this entry must have a vapour pressure at 70°C not exceeding 1.1 MPa (11 bar) and a density at 50°C not lower than 0.525 kg/L.

TIs	*UN*	
A218	(395)	• This entry must only be used for solid medical waste of Category A transported for disposal.
A219	(308)	• Stabilization of fish meal must be achieved to prevent spontaneous combustion by effective application of ethoxyquin, BHT (butylated hydroxytoluene) or tocopherols (also used in a blend with rosemary extract) at the time of production. The said application must occur within twelve months prior to shipment. Fish meal must contain at least 50 ppm (mg/kg) of ethoxyquin, 100 ppm (mg/kg) of BHT or 250 ppm (mg/kg) of tocopherol-based antioxidant at the time of consignment.
A220		• Packages containing COVID-19 pharmaceuticals accompanied by data loggers and/or cargo tracking devices containing lithium batteries are not subject to the marking and documentation requirements of Section II of Packing Instruction 967 or 970, as applicable. This same package configuration, when consigned without the COVID-19 pharmaceutical for the purpose of use or reuse, is also not subject to the marking and documentation requirements of Section II of Packing Instruction 967 or 970, as applicable, provided prior arrangements have been made with the operator.
A221	(397)	• Mixtures of nitrogen and oxygen containing not less than 19.5 per cent and not more than 23.5 per cent oxygen by volume may be transported under this entry when no other oxidizing gases are present. A Division 5.1 subsidiary hazard label is not required for any concentrations within this limit.
A222	(398)	• This entry applies to mixtures of butylenes, 1-butylene, cis-2-butylene and trans-2-butylene. For isobutylene, see UN 1055.

	A223	(≈296)	• Life-saving appliances packed in strong rigid outer packagings with a total maximum gross mass not exceeding 40 kg, containing no dangerous goods other than Division 2.2 compressed or liquefied gases (with no subsidiary hazard) contained in receptacles with a capacity not exceeding 120 mL and installed solely for the purpose of the activation of the appliance, are not subject to these Instructions when carried as cargo.
	A224		• UN 3548 – **Articles containing miscellaneous dangerous goods, n.o.s.** may be transported on passenger and cargo aircraft irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided that: d) with the exception of lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable, the only dangerous goods contained in the article is an environmentally hazardous substance; e) the articles are packed in accordance with Packing Instruction 975; and f) reference to Special Provision A224 is made on the dangerous goods transport document as required by Part 5;4.1.5.8. All other provisions of these Instructions apply. If the above conditions are met, the requirements of Special Provision A2 do not apply.
	A225		• UN 3538 – **Articles containing non-flammable, non-toxic gas, n.o.s.** may be transported on passenger and cargo aircraft irrespective of the indication of "forbidden" in columns 10 to 13 of Table 3-1, provided that: d) with the exception of lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable, the only dangerous goods contained in the article is a Division 2.2 gas without a subsidiary hazard, but excluding refrigerated liquefied gases and gases forbidden for transport on passenger aircraft; e) the articles are packed in accordance with Packing Instruction 222; and f) reference to Special Provision A225 is made on the dangerous goods transport document as required by Part 5;4.1.5.8. All other provisions of these Instructions apply. If the above conditions are met, the requirements of Special Provision A2 do not apply.
+	**A226**	(399)	• For articles that meet the definition for **Detonators, electronic** as described in Attachment 2 and assigned to UN Nos. 0511, 0512 and 0513, the entries for **Detonators, electric** (UN Nos. 0030, 0255 and 0456) may continue to be used until 30 June 2025.
+	**A228**	(401)	• Sodium ion cells and batteries with organic electrolyte must be transported as UN 3551 or UN 3552 as appropriate. Sodium ion batteries with aqueous alkali electrolyte must be transported as UN 2795 **Batteries, wet, filled with alkali**, electric storage.
+	**A229**	(402)	• Substances transported under this entry must have a vapour pressure at 70°C not exceeding 1.1 MPa (11 bar) and a density at 50°C not lower than 0.525 kg/L.

	A230	(403)	• Nitrocellulose (NC) membrane filters covered by this entry with NC content not exceeding 53 g/m² and an NC net weight not exceeding 300 g per inner packaging, are not subject to the requirements of these Instructions if they meet the following conditions: a) they are packed with paper separators of minimum 80 g/m² placed between each layer of NC membrane filters; b) they are packed to maintain the alignment of the NC membrane filters and the paper separators in any of the following configurations: 1) rolls tightly wound and packed in plastic foil of minimum 80 g/m² or aluminium pouches with an oxygen permeability of equal or less than 0.1 per cent according to standard ISO 15105-1:2007; 2) Sheets packed in cardboard of minimum 250 g per square metre or aluminium pouches with an oxygen permeability of equal or less than 0.1 per cent according to standard ISO 15105-1:2007; or 3) round filters packed in disc holders or cardboard packaging of minimum 250 g per square metre or single packed in pouches of paper and plastic material of total minimum 100 g per square metre.
	A231	(404)	• Vehicles powered by sodium ion batteries, containing no other dangerous goods, are not subject to other provisions of these Instructions, if the battery is short-circuited, in a way that the battery does not contain electrical energy. The short-circuiting of the battery must be easily verifiable (such as busbar between terminals).
	A232	(407)	• Fire suppressant dispersing devices are articles that contain a pyrotechnic substance, are intended to disperse a fire extinguishing agent (or aerosol) when activated, and do not contain any other dangerous goods. These articles, as packaged for transport, must fulfil the criteria for Division 1.4S, when tested in accordance with test series 6(c) of Section 16 of Part 1 of the UN *Manual of Tests and Criteria*. The device must be transported with either the means of activation removed or equipped with at least two independent means to prevent accidental activation. • Fire suppressant dispersing devices must only be assigned to Class 9, UN 3559, if the following additional conditions are met: a) the device meets the exclusion criteria in Segment 2;1; b) the suppressant must be deemed safe for normally occupied spaces in compliance with international or regional standards (such as NFPA2010); and c) the article must be packaged in a manner such that when activated, temperatures of the outside of the package must not exceed 200°C; This entry must be used only with the approval of the appropriate national authority of the State of manufacture. This entry does not apply to UN 3268 **Safety devices**, electrically initiated, described in Special Provision A115.
+	**A233**	(408)	• This entry applies only to aqueous solutions comprised of water, tetramethylammonium hydroxide (TMAH), and no more than 1 per cent other constituents. Other formulations containing TMAH must be assigned to an appropriate generic or n.o.s. entry (such as UN 2927, **Toxic liquid, corrosive, organic, n.o.s.**, etc.), except as follows: a) other formulations containing a surfactant in a concentration of more than 1 per cent and with not less than 8.75 per cent TMAH must be assigned to UN 2927, Packing Group I; and b) other formulations containing a surfactant in a concentration of more than 1 per cent and with more than 2.38 per cent but less than 8.75 per cent TMAH must be assigned to UN 2927, Packing Group II.
+	**A234**	(409)	• Deleted

Segment 3 Section 4

DANGEROUS GOODS IN LIMITED QUANTITIES

(1). APPLICABILITY

4.1.1 Limited quantities of dangerous goods may only be carried in accordance with the limitations and provisions of this chapter and must meet all the applicable requirements of the Technical Standards unless otherwise provided for below.

4.1.2 Only dangerous goods which are permitted on passenger aircraft, and which meet the criteria of the following classes, divisions and packing groups (if appropriate) may be carried under these provisions for dangerous goods in limited quantities:

Class 2	Only **UN 1950** in Divisions 2.1 and 2.2, **UN 2037** in Divisions 2.1 and 2.2 without a subsidiary hazard, **UN 3478** (Fuel cell cartridges, containing liquefied flammable gas) and **UN 3479** (Fuel cell cartridges, containing hydrogen in metal hydride)
Class 3	Packing Groups II and III and **UN 3473** (Fuel cell cartridges, containing flammable liquids)
Division 4.1	Packing Groups II and III but excluding **UN 2555, UN 2556, UN 2557, UN 2907**, polymerizing substances and all self-reactive substances
Division 4.3	Packing Groups II and III, solids only and **UN 3476** (Fuel cell cartridges, containing water-reactive substances)
Division 5.1	Packing Groups II and III
Division 5.2	Only when contained in a chemical kit or a first-aid kit
Division 6.1	Packing Groups II and III
Class 8	Packing Groups II and III and **UN 3477** (Fuel cell cartridges, containing corrosive substances) but excluding **UN 2794**, **UN 2795, UN 2803, UN 2809, UN 3028 and UN 3506**
Class 9	Only **UN 1941, UN 1990, UN 2071, UN 3077, UN 3082, UN 3316, UN 3334, UN 3335 and ID 8000**

(2) Many articles or substances, including the following, are NOT permitted under these limited quantity provisions:

a) those permitted only on cargo aircraft;

b) those in Packing Group I;

c) those in Class 1 or 7 or Divisions 2.1 (except as permitted above), 2.3 or 6.2; *those in Division 4.2*

or with a subsidiary hazard of 4.2.

(3). The limitations and provisions of this chapter for the transport of dangerous goods in limited quantities apply equally to both passenger and cargo aircraft.

(4). PACKING AND PACKAGINGS

(a) The general packing requirements of 4;1.1 applicable to passenger aircraft must be met except that the requirements of 4;1.1.2, 4;1.1.9

(b) , 4;1.1.9 e), 4;1.1.16, 4;1.1.18 and 4;1.1.20 do not apply.

(c) Packagings, including closures, which have been used more than once (that is, they have been refilled and are being reshipped after having previously been emptied) must be inspected thoroughly and must be in such condition that they will protect their contents and perform their containment functions as efficiently as new packagings. Cushioning and absorbent materials if used previously must remain capable of performing their primary functions

(d) Single packagings, including composite packagings, are not permitted.

(e) Limited quantities of dangerous goods must be packed in accordance with the applicable limited quantity packing instruction identified by the prefix letter “Y” indicated in column 10 of Table 3-1.

(f) Inner packagings must meet the requirements of 6;3.2. Outer packagings must be so designed that they meet the construction requirements in 6;3.1 which apply to the type of outer packaging to be used for the article or substance.

(5). QUANTITY LIMITATIONS

(a). The net quantity per package must not exceed the quantity specified in column 11 of Table 3-1 against the packing instruction number identified by the prefix letter “Y” in column 10.

(b).The gross mass per package must not exceed 30 kg.

(c). When different dangerous goods are contained in one outer packaging, the quantities of such dangerous goods must be so limited that:

(6). For classes other than Classes 2 (except UN 2037, UN 3478 and UN 3479) and 9, the total net quantity in the package does not exceed the value of 1, where “Q” is calculated using the formula:

$$Q=\frac{n_1}{M_1}+\frac{n_2}{M_2}+\frac{n_3}{M_3}+\ldots$$

where n_1, n_2, etc., are the net quantities of the different dangerous goods and M_1, M_2 etc., are the maximum net quantities for these different dangerous goods shown in Table 3-1 against the relevant “Y” packing instructions; and

for Classes 2 (except UN 2037, UN 3478 and UN 3479) and 9:

(a). when packed together without goods of other classes, the gross mass of the package does not exceed 30 kg; or

(b). when packed together with goods of other classes, the gross mass of the package does not exceed 30 kg and the total net quantity in the package of goods other than in Classes 2 (except UN 2037, UN 3478 and UN 3479) or 9 does not exceed the value of 1 when calculated according to a) above.

(7). Carbon dioxide, solid (dry ice), UN 1845 may be packed together with goods of other classes, provided that the gross mass of the package does not exceed 30 kg. The quantity of dry ice does not need to be taken into account in the calculation of the “Q” value. However, the packaging containing the carbon dioxide, solid (dry ice) and the outer packaging must permit the release of carbon dioxide gas.

(8). Where the different dangerous goods in the outer packaging consist only of those with the same UN number, packing group and physical state (that is, solid or liquid), the calculation in 4.3.3 a) does not need to be made. However, the total net quantity in the package must not exceed the maximum net quantity according to Table 3-1.

(9). PACKAGE TESTING

Each package offered for transport must be capable of:

(a). Withstanding a 1.2 m drop test on to a rigid, non-resilient, flat and horizontal surface, in the position most likely to cause damage.

(b). The criteria for passing the test is that the outer packaging must not exhibit any damage liable to affect safety during transport and there must be no leakage from the inner packaging(s).

(10). Each package offered for transport must be capable of:

(a). withstanding, without breakage or leakage of any inner packaging and without significant reduction of effectiveness, a force applied to the top surface for a duration of 24 hours equivalent to the total weight of identical packages if stacked to a height of 3 m (including the test sample).

(10). PACKAGE MARKING

(a). Packages containing limited quantities of dangerous goods must be marked as required by the applicable paragraphs of 5;2, except that 5;2.4.4.1 does not apply.

(b). Packages containing limited quantities of dangerous goods and prepared in accordance with this chapter must bear the mark shown in Figure 3-1 below. The mark must be readily visible, legible and able to withstand open weather exposure without a substantial reduction in effectiveness. The mark must be in the form of a square set at an angle of 45°(diamond shaped). The top and bottom portions and the surrounding line must be black. The centre area must be white or a suitable contrasting background. The minimum dimension must be 100 mm × 100 mm and the minimum width of the line forming the diamond must be 2 mm. The symbol “Y” must be placed in the centre of the mark and must be clearly visible. Where dimensions are not specified, all features must be in approximate proportion to those shown.

(11). If the size of the package so requires, the minimum outer dimensions shown in Figure 3-1 may be reduced to be not less than 50 mm × 50 mm provided the mark remains clearly visible. The minimum width of the line forming the diamond may be reduced to a minimum of 1 mm. The symbol “Y” must remain in approximate proportion to that shown in Figure 3-1.

(a). The entire mark must appear on one side of the package.

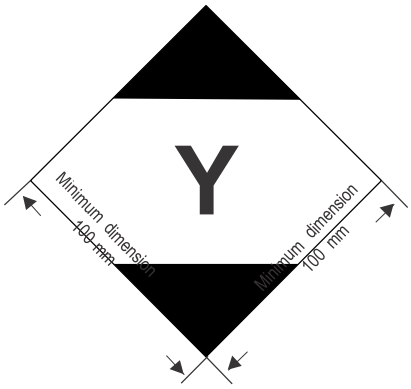
(12). An overpack containing dangerous goods packed in limited quantities must be:

(a). marked with the word “OVERPACK” in lettering of at least 12 mm high

(b). labelled as required by this chapter

(c). marked with the other marks required by this chapter; and

unless the marks and labels representative of all dangerous goods in the overpack are visible.



Limited quantities mark

(15). DANGEROUS GOODS TRANSPORT DOCUMENT

The dangerous goods transport document must comply with all the requirements of the technical Standards.

Segment 3 Section 5

DANGEROUS GOODS PACKED IN EXCEPTED QUANTITIES

(1). Excepted quantities of dangerous goods of certain classes, other than articles, meeting the provisions of this chapter are not subject to any other provisions of these Instructions except for:

Exception 1	the prohibition in post in 1;2.3;
Exception 2	the definitions in 1;3;
Exception 3	the training requirements in 1;4;
Exception 4	the classification procedures and packing group criteria in Part 2;
Exception 5	the packaging requirements of 4;1.1.1, 4;1.1.3.1, 4;1.1.3.3, 4;1.1.5, 4;1.1.6, 4;1.1.7 and 4;1.1.8 (4;1.1.6 does not apply to UN 3082);
Exception 6	the loading restriction in 92.01.29 to 41;

Exception 7	the reporting requirements of dangerous goods accidents, incidents and other occurrences in 92.01.29 to 41
Exception 8	the prohibition of dangerous goods in baggage in 92.01.3.4.1.

(2). Dangerous goods which may be carried as excepted quantities in accordance with this chapter are shown in column 9 of the dangerous goods list by means of an alphanumeric code as indicated in Table 3-3 below:

Excepted quantity codes for Table 3-1

Code	*Maximum quantity per outer packaging*	*Maximum quantity per inner packaging*
E0	Not permitted as Excepted Quantity	
E1	1 kg/1 L	30 g/30 mL
E2	500 g/500 mL	30 g/30 mL
E3	300 g/300 mL	30 g/30 mL
E4	500 g/500 mL	1 g/1 mL
E5	300 g/300 mL	1 g/1 mL

(a). For gases, the volume indicated for inner packagings refers to the water capacity of the inner receptacle and the volume indicated for outer packagings refers to the combined water capacity of all inner packagings within a single outer packaging.

(b). Where dangerous goods in excepted quantities for which different codes are assigned are packaged together, the total quantity per outer packaging must be limited to that corresponding to the most restrictive Code.

(3). Packaging's used for the transport of dangerous goods in excepted quantities must be in compliance with the following:

(a). there must be an inner packaging and each inner packaging must be constructed of plastic (when used for liquid dangerous goods it must have a thickness of not less than 0.2 mm), or of glass, porcelain, stoneware, earthenware or metal and the closure of each inner packaging must be held securely in place with wire, tape or other positive means; any receptacle having a neck with moulded screw threads must have a leakproof threaded type cap. The closure must be resistant to the contents;

(b). each inner packaging must be securely packed in an intermediate packaging with cushioning material in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents. For liquid dangerous goods, the intermediate or outer packaging must

contain sufficient absorbent material to absorb the entire contents of the inner packagings. When placed in the intermediate packaging, the absorbent material may be the cushioning material. Dangerous goods must not react dangerously with cushioning, absorbent material and packaging material or reduce the integrity or function of the materials. Regardless of its orientation, the package must completely contain the contents in case of breakage or leakage.

(4). the intermediate packaging must be securely packed in a strong, rigid outer packaging (wooden, fibreboard or other equally strong material).

(a). each package type must be in compliance with the provisions in 5.3;

(b). each package must be of such a size that there is adequate space to apply all necessary marks; and

(c). overpacks may be used and may also contain packages of dangerous goods or goods not subject to these Instructions provided that the packages are secured within the overpack.

(5). The complete package as prepared for transport, with inner packagings filled to not less than 95 per cent of their capacity for solids or 98 per cent for liquids, must be capable of withstanding, as demonstrated by testing which is appropriately documented, without breakage or leakage of any inner packaging and without significant reduction in effectiveness:

(a). drops onto a rigid, non-resilient flat and horizontal surface from a height of 1.8 m:

(b). where the sample is in the shape of a box, it must be dropped in each of the following orientations:

Drop 1	flat on the base
Drop 2	flat on the top
Drop 3	flat on the longest side
Drop 4	flat on the shortest side
Drop 5	on a corner

(c). where the sample is in the shape of a drum, it must be dropped in each of the following orientations:

Orientation 1	diagonally on the top chime, with the centre of gravity directly above the point of impact
Orientation 2	diagonally on the base chime
Orientation 3	flat on the side

(d). a force applied to the top surface for a duration of 24 hours, equivalent to the total weight of identical packages if stacked to a height of 3 m (including the sample).

(6). For the purposes of testing, the substances to be transported in the packaging may be replaced by other substances except where this would invalidate the results of the tests. For solids, when another substance is used, it must have the same physical characteristics (mass, grain size, etc.) as the substance to be carried. In the drop tests for liquids, when another substance is used, its relative density (specific gravity) and viscosity must be similar to those of the substance to be transported.

(7). The mark must be in the form of a square. The hatching and symbol must be of the same colour, black or red, on white or suitable contrasting background. The dimensions of the mark must be a minimum of 100 mm □ 100 mm. Where dimensions are not specified, all features must be in approximate proportion to those shown.

(8). The entire mark must appear on one side of the package.

(9). An overpack containing dangerous goods packed in excepted quantities must be

(a). marked with the other marks required by this chapter

(b). marked with the word “OVERPACK” in lettering of at least 12 mm high; and

unless the marks representative of all dangerous goods on packages in the overpack are clearly visible. The other provisions of 5;2 apply only if other dangerous goods which are not packed in excepted quantities are contained in the overpack and only in relation to these other dangerous goods.

(10). If a document such as an air waybill accompanies dangerous goods in excepted quantities, it must include the statement “Dangerous Goods in Excepted Quantities” and indicate the number of packages.

(11). Dangerous goods assigned to codes:

E1,

E2,

E4

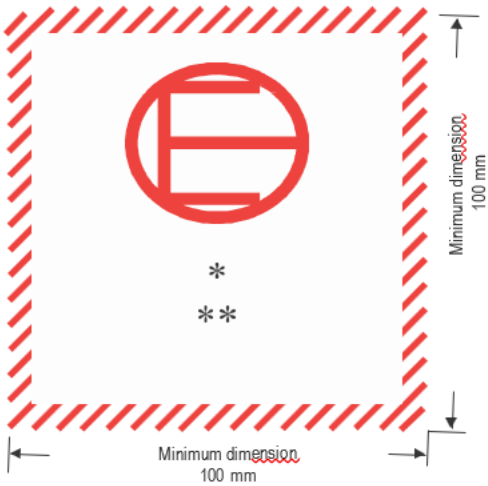
E5 are not subject to these Instructions when carried as cargo provided that:

a) the maximum net quantity per inner packaging is limited to 1 mL for liquids and gases and 1 g for solids;

b) the provisions of 5.2 are met, except that an intermediate packaging is not required if the inner packagings are securely packed in an outer packaging with cushioning material in such a way that, under normal conditions of transport, they cannot break, be punctured, or leak their contents; and for liquid dangerous goods, the outer packaging contains sufficient absorbent material to absorb the entire contents of the inner packagings;

c) the provisions of 5.3 are complied with; and

d) the maximum net quantity of dangerous goods per outer packaging does not exceed 100 g for solids or 100 mL for liquids and gases.



* Place for class or, when assigned, the division number(s)

** Place for name of shipper or consignee, if not shown elsewhere on the package

SEGMENT 4

PACKING INSTRUCTIONS

INTRODUCTORY NOTES

Note 1. — Packing groups

For packing purposes, dangerous goods other than those of Classes 1, 2 and 7, Divisions 5.2 and 6.2 and self-reactive substances of Division 4.1 are assigned to three packing groups in accordance with the degree of danger they present:

Packing Group I – Substances presenting high danger Packing Group II –Substances presenting low danger Packing Group III – Substances presenting medium danger

Some substances in Class 9 and liquids in Division 5.1 have been assigned to packing groups by experience rather than through application of technical criteria. The packing group to which a substance is assigned is listed in Table 3-1. The criteria for the packing groups are given in Segment 2, Sections 3, 4, 5, 6 and 8.

Note 2. — Temperature variations

For the information of users of these Instructions, the extremes of temperature which may be encountered in international transportation are in the order of –40°C and 55°C. Since receptacles or packagings may be filled at low temperatures and then exposed in transit in tropical areas, the increase in temperature may tend to cause discharge of liquid contents or bursting of the receptacles or packagings during transit, unless a suitable ullage (outage) has been provided and the receptacles or packagings meet the pressure requirement specified in this Segment.

Note 3. — Pressure variations

Due to altitude, the ambient pressure experienced by a package in flight will be lower than standard atmospheric pressure at sea level. Since receptacles or packaging's will generally be filled at a:

- standard atmospheric pressure of approximately **100 kPa,** this lower ambient pressure will result in a pressure differential between the contents of the receptacle or package and the cargo compartment.
- For pressurized cargo compartments, the pressure differential may be approximately **25 kPa**, while for non-pressurized or partially pressurized cargo compartments, the pressure differential may be as much as **75 kPa.**
- This pressure differential will tend to cause discharge of liquid contents or bursting of the receptacles or packaging's during flight unless each receptacle or packaging and its closures meet the packaging test requirements.

Note 4. — Vibrations

Vibrations in commercial aircraft to which packaging may be exposed range from:

- mm amplitude at **7 Hz** (corresponding to 1 g acceleration),
- to **0.05** mm amplitude at **200 Hz** (corresponding to 8 g acceleration).

Note 5. — Nomenclature

A nomenclature of some packaging terms used in the Technical Standardsis given in 1;3.1. Explanations of the codes used in this Segment to designate types of inner and outer packagings may be found in Tables 6-2 and 6-3.

Note 6. — Portable tanks

With the approval of the appropriate authority of the State of Origin and the State of the Operator, certain dangerous goods may also be carried on cargo aircraft in portable tanks.

Note 7. — Carriage of oxygen and air with aquatic animals

With the approval of the appropriate authority of the State of Origin and the State of the Operator, for the purpose of providing life support to aquatic animals during transport, cylinders containing Oxygen compressed (UN 1072) or Air, compressed (UN 1002) may be carried to oxygenate the water in accordance with the provisions of Table S-3-1 and Special Provision A302 (which appear in the Supplement).

Note 8.— Packagings for explosives, self-reactive substances and organic peroxides

Unless specific provisions are made in these Instructions, the packagings used for goods of Class 1, self-reactive substances of Division 4.1 and organic peroxides of Division 5.2 should comply with the provisions for the medium danger (Packing Group II) category.

Note 9. — Additional requirements for the air mode

The transport of dangerous goods by air is subject to requirements additional to those of other modes of transport (such as quantity limitations, requirements for absorbent material, pressure differential requirements, appropriate closure procedures, specific packing instruction requirements).

Note 10. — Carriage of flames

With the approval of the appropriate authority of the State of Origin and the State of the Operator, lamps fueled by:

- UN 1223 – **Kerosene** or
- UN 3295 – **Hydrocarbons, liquid, n.o.s.**, carried by a passenger to transport a symbolic flame (such as Olympic flame, Peace flame) may be carried in accordance with the provisions of **Special Provision A324** (which appears in the Supplement to this document).

Note 11. — Open external carriage

When dangerous goods are prepared for open external carriage (such as suspended from a helicopter or in open external carrying devices), consideration should be given to the type of packaging used and protection of those packagings where necessary from the effects of airflow and weather (such as by damage from rain or snow).

Note 12. — Large packagings

With the approval of the appropriate authority of the State of Origin and the State of the Operator, an article with a total net mass exceeding 400 kg may be packed in large packagings and carried on cargo aircraft.

Section 1

GENERAL PACKING REQUIREMENTS

1.1 GENERAL REQUIREMENTS APPLICABLE TO ALL CLASSES EXCEPT CLASS 7

1.1.1 Dangerous goods must be packed in good quality packagings, which must be strong enough to withstand the shocks and loadings normally encountered during transport, including removal from a pallet, unit load device or overpack for subsequent manual or mechanical handling. Packagings must be constructed and closed so as to prevent any loss of contents when prepared for transport, which may be caused under normal conditions of transport, by vibration, or by changes in temperature, humidity or pressure (resulting from altitude, for example). Packagings (including inner packagings and receptacles) must be closed in accordance with the information provided by the manufacturer. No dangerous residue must adhere to the outside of packages during transport. These provisions apply, as appropriate, to new, reused, reconditioned or re-manufactured packagings.

Note. — The nature of transport dictates that many packages are likely to be moved between different modes of transport with the attendant increase in handling, such as from vehicles into warehouses and then onto aircraft. Additionally, packages consigned on a pallet may be removed from that pallet to assist handling and loading which may be carried out manually. To avoid damage and leakage from packages during transport, shippers should take this into account in selecting an appropriate packaging or in making the decision about the suitability of an already packaged item. In this respect, it is recommended that single steel or aluminium packagings (1A1, 1A2, 1B1, 1B2, 3A1, 3A2, 3B1, 3B2), when transported in narrow-bodied aircraft and not otherwise protected by, for example, placement in a unit load device, be provided additional protection against the abrasive effects experienced in loading the aircraft through overpacking, palletization or other means of protecting the bottom head and chime. Also, small single packagings, with a capacity of 2 L or less, should be overpacked to facilitate handling and to permit adequate securing of the dangerous goods aboard the aircraft.

1.1.2 New, remanufactured, reused or reconditioned packagings which are listed in Tables 6-2 and 6-3, must meet the applicable requirements of Segment 6 of these Instructions. Such packagings must be manufactured and tested under a quality assurance programme which satisfies the appropriate national authority, in order to ensure that such packagings meet those applicable requirements. Packagings may conform to one or more than one successfully tested design type and may bear more than one mark required by 6;2. Where packagings are required to be tested in accordance with 6;4, their subsequent use must be as specified in the applicable test report and conform in all respects with the design type which was tested, including the method of packing and size and type of any inner packagings, except as provided for in 1.1.10.1 or 6;4.1.7. Before being filled and handed over for transport, every packaging must be inspected to ensure that it is free from corrosion, contamination or other damage. Any packaging which shows signs of reduced strength as compared with the approved design type must no longer be used or must be so reconditioned that it is able to withstand the design type tests.

1.1.3 Compatibility requirements

1.1.3.1 Parts of packagings which are in direct contact with dangerous goods:

a) must not be affected or significantly weakened by those dangerous goods;

b) must not allow permeation of the dangerous goods that could constitute a danger under normal conditions of transport.

c) Where necessary, they must be provided with a suitable inner coating or treatment.

1.1.3.2 Shippers must also ensure that any absorbent materials and the materials of intermediate packagings for liquids do not react dangerously with the liquid.

1.1.3.3 Materials, such as some plastics, which can be significantly softened or rendered brittle or permeable by the temperatures likely to be experienced during transport or because of the chemical action of the contents or the use of a refrigerant, must not be used. Even though certain packagings are specified in individual packing instructions, it is, nevertheless, the responsibility of the shipper to ensure that such packagings are, in every way, compatible with the articles or substances to be contained within such packagings. This particularly applies to corrosivity, permeability, softening, premature aging and embrittlement.

Particular attention should be paid to the following:

a) the effect of fluorine on glass;
b) consideration of the interaction (such as swelling, permeation, chemical degradation and environmental stress cracking) of substances with polymer materials such as polyethylene and polypropylene
c) the effects of corrosion on metals such as steel and aluminium; and

1.1.3.4 Shippers must ensure that all appropriate measures have been taken to ensure that the packagings used are compatible with the dangerous goods to be transported. Evidence of such measures or assessments must be made available to the competent authority upon request.

1.1.4 The body and the closure of any packaging must be so constructed as to be able to adequately resist the effects of temperature and vibration occurring in normal conditions of transport. The closure device must be so designed that it:

a) is unlikely that it can be incorrectly or incompletely closed, and must be such that it may be checked easily to determine that it is completely closed; and
b) remains securely closed during transport.

1.1.4.1 In addition, for inner packagings containing liquids,

- closures must be held securely, tightly and effectively in place by secondary means.
- Examples of such methods include:

1) adhesive tape,
2) friction sleeves,
3) welding or soldering,
4) positive locking wires,
5) locking rings,
6) induction heat seals and child-resistant closures.

- When secondary means of closure cannot be applied, the inner packaging must be securely closed and placed in a leakproof liner and then placed in an outer packaging.

1.1.5 When filling packagings for liquids sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the packaging will occur because of an expansion of the liquid caused by temperatures likely to prevail during transport. Liquids must not completely fill a packaging at a temperature of 55°C.

≠ 1.1.6 Packagings for which retention of liquid is a basic function must be capable of:

- withstanding without leakage an internal pressure which produces a pressure differential of not less than 95 kPa (not less than 75 kPa for liquids in Packing Group III of Class 3, Division 6.1 or Class 9),

- or a pressure related to the vapour pressure of the liquid to be conveyed, whichever is the greater. The pressure related to the vapour pressure must be determined as either:

a) the total gauge pressure measured in the packaging (that is, the vapour pressure of the filling substance and the partial pressure of the air or other inert gases, less 100 kPa) at 55°C, multiplied by a safety factor of 1.5; this total gauge pressure should be determined on the basis of a degree of filling in accordance with 1.1.5 and a filling temperature of 15°C; or

b) 1.75 times the vapour pressure at 50°C less 100 kPa, but

with a minimum of 95 kPa. This is expressed as:

$P = (V_{p50} \times 1.75) - 100$ kPa with a

minimum of 95 kPa where

P = Pressure requirement in kPa (gauge)

V_{p50} = Vapour pressure at 50°C; or

c) 1.5 times the vapour pressure at 55°C less 100 kPa, but

with a minimum of 95 kPa. This is expressed as:

$P = (V_{p55} \times 1.5) - 100$ kPa with a

minimum of 95 kPa where

P = Pressure requirement in kPa (gauge)

V_{p55} = Vapour pressure at 55°C.

Note.— The capability of a packaging to withstand the following:

- *an internal pressure without leakage that produces the specified pressure differential should be determined by testing samples of inner packagings of combination packagings and single packagings.*
- *Pressure differential is the difference between the pressure exerted on the inside of the packaging and the pressure on the outside.*
- *The appropriate test method should be selected based on packaging type.*
- *Acceptable test methods include any method that produces the required pressure differential between the inside and outside of a single packaging or an inner packaging of a combination packaging.*
- *The test may be conducted using internal hydraulic or pneumatic pressure (gauge) or external vacuum test methods.*
- *Internal hydraulic or pneumatic pressure can be applied in most cases as the required pressure differential can be achieved under most circumstances.*
- *An external vacuum test is not acceptable if the specified pressure differential is not achieved and maintained. The external vacuum test is a generally acceptable method for rigid packagings but is not normally acceptable for:*

— *flexible packagings;*

— *packagings filled and closed under an absolute atmospheric pressure lower than 95 kPa or for liquids in Packing Group III of Class 3 or Division 6.1 with an absolute pressure of 75 kPa;*

— *packagings intended for the transport of high vapour pressure liquids (that is, vapour pressure greater than 111 kPa at 50°C or 130 kPa at 55°C and accordingly greater than 100 kPa at 50°C or 117 kPa at 55°C for liquids) in Packing Group III of Class 3 or Division 6.1.*

1.1.7 Notwithstanding the foregoing, dangerous goods may be contained in an inner packaging which does not itself meet the pressure requirement provided that the inner packaging is packed within a supplementary packaging which does meet the pressure requirement and all the other requirements of this Section and the applicable packing instruction.

1.1.8 Dangerous goods must not be packed together in the same outer packaging with dangerous or other goods if they react dangerously with each other and cause:

a) combustion and/or evolution of considerable heat;
b) the formation of unstable substances.
c) evolution of flammable, toxic or asphyxiant gases;
d) the formation of corrosive substances; or

1.1.9 Subject to 1.1.8 an outer packaging may contain more than one item of dangerous goods provided that:

a) the inner packaging used for each item of dangerous goods and the quantity contained therein complies with the relevant part of the packing instruction applicable to that item;
b) the outer packagings used are permitted by all the packing Technical Standardsapplicable to each item of dangerous goods;
c) the package as prepared for shipment meets the specification performance tests for the most restrictive packing group of a substance or article contained in the package;
d) the dangerous goods do not require segregation according to Table 7-1, unless otherwise provided for in these Instructions; and
e) the quantities of different dangerous goods contained in one outer packaging must be such that “Q” does not exceed the value of 1, where “Q” is calculated using the formula:

$$Q = \frac{n1}{M1} + \frac{n2}{M2} + \frac{n3}{M3} + \ldots$$

where n_1, n_2, etc. are the net quantities of the different dangerous goods and M_1, M_2, etc. are the maximum net quantities for these different dangerous goods according

to Table 3-1 for passenger or cargo aircraft, as applicable. However, the following dangerous goods do not need to be taken into account in the calculation of the "Q" value:

1) carbon dioxide, solid (dry ice), UN 1845;
2) those with the same UN number, packing group, and physical state (that is, solid or liquid) and the same maximum net quantity according to column 11 or 13 of Table 3-1, providing they are the only dangerous goods in the package and the total net quantity does not exceed the maximum net quantity according to Table 3-1.
3) those where columns 11 and 13 of Table 3-1 indicate "No limit";

Outer packaging containing Division 6.2 (Infectious Substances) may contain material for refrigeration or freezing or packaging material such as absorbent material.

Note. — For packages containing radioactive material, see 9.1.3.

1.1.10 Inner packagings must be so packed, secured or cushioned in an outer packaging in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the outer packaging. Inner packagings containing liquids must be packaged with their closures upward and placed within outer packagings consistent with the orientation mark prescribed in 5;3.2.12 b) of these Instructions. Inner packagings that are liable to break or be punctured easily, such as those made of glass, porcelain or stoneware or of certain plastic material, must be secured in outer packagings with suitable cushioning material. Any leakage of the contents must not substantially impair the protective properties of the cushioning material or of the outer packaging.

1.1.10.1 Where an outer packaging of a combination packaging has been successfully tested with different types of inner packagings, a variety of such different inner packagings may also be assembled in this outer packaging. In addition, provided an equivalent level of performance is maintained, the following variations in inner packagings are allowed without further testing of the package:

a) inner packagings of equivalent or smaller size may be used provided:

   1) the inner packagings are of similar design to the tested inner packagings (such as shape – round, rectangular);
   2) sufficient additional cushioning material is used to take up void spaces and to prevent significant movement of the inner packagings; and
   3) the material of construction of the inner packagings (glass, plastics, metal, etc.) offers resistance to impact and stacking forces equal to or greater than that of the originally tested inner packaging;
   4) the inner packagings have the same or smaller openings and the closure is of similar design (screw cap, friction lid, etc.);
   5) inner packagings are oriented within the outer packaging in the same manner as in the tested package; and

b) a lesser number of the tested inner packagings, or of the alternative types of inner packagings identified in a) above, may be used provided sufficient cushioning is added to fill the void space(s) and to prevent significant movement of the inner packagings.

1.1.10.2 Use of supplementary packagings within an outer packaging (such as an intermediate packaging or a receptacle inside a required inner packaging) additional to what is required by the packing Technical Standardsis permitted provided all relevant requirements are met, including those of 4;1.1.2, and, if appropriate, suitable cushioning is used to prevent movement within the packaging.

1.1.11 The nature and the thickness of the outer packaging must be such that friction during transport does not generate any heat likely to alter dangerously the chemical stability of the contents.

1.1.12 Venting of packagings to reduce internal pressure, which may develop by the evolution of gas from the contents, is not permitted for air transport, except as otherwise specified in these Instructions.

1.1.13 Except as provided in Segment 1, combination packagings having inner packagings containing liquid dangerous goods must be packed so that the closures on the inner packagings are upward and the upright position of the package must be indicated on it by the “Package orientation” label described in Segment 5;3. The words “This side up” or “This end up” may also be displayed on the top cover of the package.

1.1.13.1 Orientation arrows are not required on outer packagings containing:

a) dangerous goods in inner packagings each containing not more than 120 mL with sufficient absorbent material between the inner and outer packagings to completely absorb the liquid contents;

b) Division 6.2 infectious substances in primary receptacles each containing not more than 50 mL; or

c) dangerous goods in gas tight inner packagings such as tubes, bags or vials which are opened by breaking or puncturing. Each inner packaging must not contain more than 500 mL.

1.1.14 Except as provided in Segment 5;3, a package must be of such size that there is adequate space to affix all necessary labels and marks.

1.1.15 An empty packaging that has contained a dangerous substance must be treated in the same manner as is required by these Technical Standardsfor a package filled with that substance unless adequate measures have been taken to nullify any hazard.

Note. — Purging and thorough flushing of the packaging with a neutralizing agent is an acceptable method of nullifying the hazard.

1.1.16 Packagings tested as prescribed in Segment 6;4.5 and marked with the hydraulic test pressure prescribed in Segment 6;2.1.1 d) 1) must be filled only with a liquid having a vapour pressure:

a) such that the total gauge pressure in the packaging (that is, the vapour pressure of the filling substance plus the partial pressure of air or other inert gases, less 100 kPa) at 55°C, determined on the basis of a maximum degree of filling in accordance with 1.1.5 and a filling temperature of 15°C, will not exceed two-thirds of the marked test pressure; or

b) at **50°C** less than four-sevenths of the sum of the marked test pressure plus **100 kPa**; or

c) at **55°C** less than two-thirds of the sum of the marked test pressure plus **100 kPa** (see Table 4-1).

However, where the packaging is selected on the basis of 1.1.16 a) the hydraulic test pressure marked in accordance with Segment 6;2.

d) 1) must be not less than 100 kPa (not less than 80 kPa for liquids in Packing Group III of Class 3 or Division 6.1).

1.1.17 Packagings used for solids which may become liquid at temperatures encountered during air transport must also be capable of containing that substance in the liquid state.

Note.— Packagings for solids (both inner and single) which may be permitted by the applicable packing instruction should not be used if they are unsuitable for containing liquids (such as paper or plastic bags as inner packagings, unlined fibre drums as single packagings, should not be used).

Table 4-1. Examples of required marked test pressures calculated as in 1.1.16 c)

UN No.	*Name*	*Class*	*V_{p55} (kPa)*	*V_{p55} × 1.5 (kPa)*	*(V_{p55} × 1.5) minus 100 (kPa)*	*Required minimum test pressure (gauge) under 6;4.5.3 c) (kPa)*	*Minimum test pressure (gauge) to be marked on the packaging (kPa)*	*Packing Group*
2056	Tetrahydrofuran	3	70	105	5	100	100	II
2247	n-Decane	3	1.4	2.1	–97.9	100	100	III
1593	Dichloromethane	6.1	164	246	146	146	150	III
1155	Diethyl ether	3	199	299	199	199	250	1

Note 1. For pure liquids the vapour pressure at 55°C (V_{p55}) can often be obtained from scientific tables.

Note 2. — The maximum vapour pressures in 1.1.16 b) and c) refer to the basis of the formula while the minimum hydraulic test pressure in the last sentence of 1.1.16 refers to the aircraft altitude.

Note 3. This table refers to the use of 1.1.16 c) only, which means that the marked test pressure must exceed 1.5 times the vapour pressure at 55°C less 100 kPa. When, for example, the test pressure for n-Decane is determined according to 6;4.5.3 a) the minimum marked test pressure of 80 kPa applies.

Note 4. For Diethyl ether the required minimum test pressure under 6;4.5.4 is 250 kPa.

1.1.18 Every packaging intended to contain liquids must successfully undergo a suitable leakproofness test. This test is part of a quality assurance programme as required by 4;1.1.2 which shows the capability of meeting the appropriate test level indicated in 6;4.4.2:

a) before it is first used for transport;

b) after remanufacturing or reconditioning, before it is reused for transport. For this test, packagings need not have their own closures fixed.

The inner receptacle of composite packagings may be tested without the outer packaging provided the test results are not affected. This test is not necessary for inner packagings of combination packagings.

1.1.19 The closures of packagings containing wetted or diluted substances must be such that the percentage of liquid (water, solvent or phlegmatizer) does not fall below the prescribed limits during transport.

1.1.20 For plastic drums and jerricans, rigid plastic IBCs and composite IBCs with plastic

inner receptacles, unless otherwise approved by the appropriate national authority, the period of use permitted for the transport of dangerous goods must be not more than five years from the date of manufacture of the receptacles, except where a shorter period of use is prescribed because of the nature of the substance to be transported.

Note. — For composite IBCs the period of use refers to the date of manufacture of the inner receptacle.

1.1.21 Where ice is used as a coolant it must not affect the integrity of the packaging.

1.2 PACKING GROUP

Unless otherwise provided for, the specification packagings (that is, those listed in Table 6-2) detailed in the packing Technical Standardsmust meet the performance test requirements of the relevant packing group shown in column 8 of Table 3-1 for the Segmenticular substance or article.

1.3 TRANSITIONAL PACKAGING ARRANGEMENTS FOR RADIOACTIVE MATERIAL

For the arrangements for the use of packagings for radioactive material manufactured under earlier requirements.

1.4 SALVAGE PACKAGINGS

1.4.1 Damaged, defective, leaking or non-conforming packages, or dangerous goods that have spilled or leaked may be transported in salvage packagings meeting the requirements of Segment 1.4 and Segment 6;4. These salvage packagings may be used provided that appropriate measures are taken to prevent excessive movement of the damaged or leaking packages within the salvage packaging and that when the salvage packaging contains liquids, sufficient absorbent material is added to eliminate the presence of free liquid. Prior approval from the appropriate national authority must be obtained to ship salvage packagings.

1.4.2 Salvage packagings must be single packagings of a material resistant to any chemical or other action of the leaking or spilled dangerous goods. Not more than one damaged, defective or leaking package of dangerous goods may be packed in any one of such single packagings.

1.4.3 Damaged, defective or leaking packages of dangerous goods of Classes 1, 2 and 7 and Division 6.2 (other than Clinical waste and Medical waste falling under UN 3291) must not be transported in salvage packagings.

1.4.4 Damaged, defective or leaking packages of self-reactive substances of Division 4.1 or substances of Division 5.2 must not be transported in metal salvage packagings meeting Packing Group I requirements.

Segment Section 2

GENERAL

2.1 Each of the succeeding Sections of this Segment is devoted to the specific packing Technical Standards applicable to an individual class of dangerous goods. In some cases the Sections start with general requirements which apply to all goods in that class.

2.2 The Dangerous Goods List (Table 3-1) shows for each article or substance, in columns 10 and 12, the number of the packing instruction that must be used.

2.3 Each instruction shows, where applicable, the acceptable single and combination packagings. For combination packagings, tables show the acceptable outer packagings and associated inner packagings with the maximum net quantity permitted in each inner packaging. Where provisions for particular articles or substances apply, a table shows the inner packagings with associated quantity limitations, the permitted quantity per package and, where applicable, an indication if single packagings are permitted. Where appropriate, additional packing requirements are also indicated at the end of a packing instruction. These additional packing requirements may impose a higher standard of packaging than would normally apply to the packing group, or may require specific packaging considerations. Where packagings which need not meet the requirements of
1.1.2 (such as crates, pallets, etc.) are authorized in a packing instruction or the special provisions named in the dangerous goods list, these packages are not subject to the mass or volume limits generally applicable to packagings conforming to the requirements of Segment 6, unless otherwise indicated in the relevant packing instruction or special provision.

2.4 Unless otherwise specified, each packaging must conform to the applicable requirements of Segment 6. Generally packing Technical Standardsdo not provide guidance on compatibility and the user must not select a packaging without checking that the substance is compatible with the packaging material selected (such as most fluorides are unsuitable for glass receptacles). Where glass receptacles are permitted in the packing instructions, porcelain, earthenware and stoneware packagings are also allowed.

2.5 The following packagings must not be used when the substances being transported are liable to become liquid during transport:
:

Drums	1D and 1G
Boxes	4C1, 4C2, 4D, 4F, 4G and 4H1
Bags	5L1, 5L2, 5L3, 5H1, 5H2, 5H3, 5H4, 5M1 and 5M2
Composite Packaging	6HC, 6HD2, 6HG1, 6HG2, 6HD1, 6PC, 6PD1, 6PD2, 6PG1, 6PG2 and 6PH1.

2.6 Where the packing Technical Standards in this Segment authorize the use of a particular type of outer packaging (such as 4G, 1A2), packagings bearing the same packaging identification code followed by the letters “V”, “U” or “W” marked in accordance with the requirements of 6;4.1.7 h) (such as 4GV, 4GU or 4GW; 1A2V, 1A2U or 1A2W) may also be used under the same conditions and limitations applicable to the use of that type of packaging according to the relevant packing instruction. For example, a combination packaging marked with the packaging code “4GV” may be used whenever a combination

packaging marked “4G” is authorized, provided the requirements in the relevant packing instruction regarding types of inner packagings and quantity limitations are respected.

2.7 Cylinders may be used for liquids and solids when indicated in a packing instruction. The cylinder must meet the standards set out below.

2.7.1 Unless otherwise indicated in these Instructions, cylinders must conform to:

a) the applicable requirements of 6;5; or

b) the national or international standards on the design, construction, testing, manufacturing and inspection, as applied by the country in which the cylinders are manufactured, provided that the provisions of 2.7 and Segment 6;5 are met.

2.7.2 Every type of design of cylinder must be approved by the competent authority of the country of manufacture or as indicated in 6;5.

2.7.3 Unless otherwise indicated, cylinders having a minimum test pressure of 0.6 MPa must be used.

2.7.4 Unless otherwise indicated, cylinders may be provided with an emergency pressure relief device designed to avoid bursting in case of overfill or fire accidents.

2.7.5 Cylinder valves must be designed and constructed in such a way that they are inherently able to withstand damage without release of the contents or must be protected from damage which could cause inadvertent release of the contents of the cylinder, by one of the methods as given in 4.1.1.9 a) to e).

2.7.6 The level of filling must not exceed 95 per cent of the capacity of the cylinder at 50°C. Sufficient ullage (outage) must be left to ensure that the cylinder will not be liquid full at a temperature of 55°C.

2.7.7 Unless otherwise indicated cylinders must be subjected to a periodic inspection and test every 5 years. The periodic inspection must include an external examination, an internal examination or alternative method as approved by the competent authority, a pressure test or equivalent effective non-destructive testing with the agreement of the competent authority including an inspection of all accessories (such as tightness of valves, emergency relief valves of fusible elements). Cylinders must not be filled after they become due for periodic inspection and test but may be transported after the expiry of the time limit. Cylinder repairs must meet the requirements of 4.1.1.11.

2.7.8 Prior to filling, the filler must perform an inspection of the cylinder and ensure that the cylinder is authorized for the substances to be transported and that the provisions of these Technical Standardshave been met. Shut-off valves must be closed after filling and remain closed during transport. The shipper must verify that the closures and equipment are not leaking.

2.7.9 Refillable cylinders must not be filled with a substance different from that previously contained unless the necessary operations for change of service have been performed.

2.7.10 Marking of cylinders for liquids and solids according to 2.7 (not conforming to the requirements of 6;5) must be in accordance with the requirements of the competent authority of the country of manufacturing.

2.8 The appropriate authority of the State of Origin may approve the use of a packaging alternative to those provided in a particular packing instruction indicated in Table 3-1 for listed dangerous goods provided:

a) the alternative packaging complies with the general requirements of 4;1;
b) the appropriate authority of the State of Origin determines that the alternative packaging achieves at least the same level of safety as if the substance were packed in accordance with a method specified in the particular packing instruction indicated in Table 3-1;
c) when the particular packing instruction indicated in Table 3-1 specifies packagings which are listed in Tables 6-2 and 6-3, the alternative packaging must meet the applicable requirements of Segment 6;
d) for the type of alternative packaging, the expressions “Not used in these Instructions” or “Specialized use only” do not appear in Table 6-2 under the “Paragraph” column heading;
e) the maximum net quantity of dangerous goods in the packaging does not exceed the quantity specified in the appropriate column of Table 3-1; and
f) a copy of the document of approval accompanies each consignment.

2.9 *Unpackaged articles other than Class 1 articles*

The appropriate authority of the State of Origin and the State of the Operator may approve the transport of large and robust articles which cannot be packaged in accordance with the requirements of 6;1 to 6;4, where they have to be transported empty, uncleaned and

unpackaged, providing they comply with the requirements in Segment S-4, Section 3 of the Supplement.

Section 3

CLASS 1 – EXPLOSIVES

3.1 PACKING GROUP

Unless otherwise specified in these Instructions, packagings must conform to the requirements of 6;1, 6;2, 6;3 and 6;4 and must meet the test requirements of 6;4 for Packing Group II.

3.2 GENERAL REQUIREMENTS

3.2.1 The general packing requirements of 4;1 must be met.

3.2.2 All packagings for Class 1 explosives must be designed and constructed so that:

a) they will protect the explosives, prevent them from escaping and cause no increase in the risk of unintended ignition or initiation when subjected to normal conditions of transport including foreseeable changes in temperature, humidity and pressure;

b) the complete package can be handled safely in normal conditions of transport; and

c) the packages will withstand any loading imposed on them by foreseeable stacking to which they will be subject during transport so that they do not add to the risk presented by the explosives, the containment function of the packagings is not harmed, and they are not distorted in a way or to an extent which will reduce their strength or cause instability of a stack.

3.2.3 All explosive substances and articles, as prepared for transport, must have been classified in accordance with the procedures detailed in 2;1.5.

3.3 GENERAL PACKING PROVISIONS

3.3.1 The general provisions detailed below are in addition to those in Segment 4, Section 1.

3.3.1.1 The closure device of packagings containing liquid explosives must ensure a double protection against leakage.

3.3.1.2 The closure device of metal drums must include a suitable gasket; if a closure device includes a screw-thread, the ingress of explosive substances into the screw-thread must be prevented.

3.3.1.3 Packagings for water soluble substances must be water-resistant.

3.3.1.4 When the packaging includes a double envelope filled with water which may freeze during transport, a sufficient quantity of an anti-freeze agent must be added to the water to prevent freezing. Anti-freeze that could create a fire hazard because of its inherent

flammability must not be used.

3.3.1.5 Nails, staples and other closure devices made of metal without protective covering must not penetrate to the inside of the outer packaging unless the inner packaging adequately protects the explosives against contact with the metal.

3.3.1.6 Inner packagings, fittings and cushioning materials and the placing of explosive substances or articles in packages must be accomplished in a manner which prevents the explosive substances or articles from becoming loose in the outer packaging under normal conditions of transport. Metallic components of articles must be prevented from making contact with metal packagings. Articles containing explosive substances not enclosed in an outer casing must be separated from each other in order to prevent friction and impact. Padding, trays, partitioning in the inner or outer packaging, mouldings or receptacles may be used for this purpose.

3.3.1.7 Packagings must be made of materials compatible with, and impermeable to, the explosives contained in the package, so that neither interaction between the explosives and the packaging materials, nor leakage, causes the explosive to become unsafe to transport, or the hazard division or compatibility group to change.

3.3.1.8 The ingress of explosive substances into the recesses of seamed metal packagings must be prevented.

3.3.1.9 Plastic packagings must not be liable to generate or accumulate sufficient static electricity so that a discharge could cause the packaged explosive substances or articles to initiate, ignite or function.

3.3.1.10 Explosive substances must not be packed in inner or outer packagings where the differences in internal and external pressures, due to thermal or other effects, could cause an explosion or rupture of the package.

3.3.1.11 Whenever loose explosive substances or the explosive substance of an uncased or partly cased article may come into contact with the inner surface of metal packagings (1A2, 1B2, 4A, 4B and metal receptacles), the metal packaging must be provided with an inner liner or coating (see 1.1.3).

3.3.1.12 Packing Instruction 101 may be used for any explosive provided the package has been approved by an appropriate national authority regardless of whether the packaging complies with the packing instruction assignment in the Dangerous Goods List.

3.3.1.13 Electro-explosive devices must be adequately protected against electro-magnetic radiation and stray currents.

3.3.1.14 Large and robust explosive articles, normally intended for military use, without their means of initiation or without their means of initiation containing at least two effective protective features, may be carried unpackaged. When such articles have propelling charges or are self-propelled, their ignition systems must be protected against stimuli encountered during normal conditions of transport. A negative result in Test Series 4 on an unpackaged article indicates that the article can be considered for transport unpackaged. Such unpackaged articles may be fixed to cradles or contained in crates or other suitable handling, storage or launching devices in such a way that they will not become loose during normal conditions of transport.

3.3.1.14.1 Where such large explosive articles are, as part of their operational safety and suitability tests, subjected to test regimes that meet the intentions of these Technical Standardsand such tests have been successfully undertaken, the appropriate national authority may approve such articles to be transported under these Instructions.

Note 1. — The term receptacle used in the Inner and Intermediate packaging columns of this table includes boxes, bottles, cans, drums, jars and tubes, including any means of closure.

Note 2. — Reels are devices made of plastics, wood, fibreboard, metal or other suitable material comprising a central spindle with, or without, side walls at each end of the spindle. Articles and substances can be wound onto the spindle and may be retained by side walls.

Note 3. — Trays are sheets of metal, plastics, wood, fibreboard or other suitable material which are placed in the inner, intermediate or outer packaging and achieve a close-fit in such packaging. The surface of the tray may be shaped so that packagings or articles can be inserted, held secure and separated from each other.

3.4 PACKING INSTRUCTIONS

Packing Instruction 101		
Inner packagings	**Intermediate packagings**	**Outer packagings**
As specified by the appropriate national authority. The distinguishing sign used on vehicles in international road traffic of the country for which the authority acts must be marked on the dangerous goods transport document as follows: “Packaging approved by the competent authority of ...” *Note 1. — In this instance the term “competent authority” is used for intermodal compatibility; it refers to the appropriate national authority.* *Note 2. The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.*		

Packing Instruction 114

a) solid wetted

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags plastics textile woven plastics **Receptacles** metal plastics wood	**Bags** plastics textile, plastic coated or lined **Receptacles** metal plastics **Dividing partitions** wood	**Boxes** fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— For UN 0077, 0234, 0235 and 0236, packagings must be lead-free.
— For UN 0342, inner packagings are not required when metal (1A1, 1A2, 1B1, 1B2, 1N1 or 1N2) or plastic (1H1 or 1H2) drums are used as outer packagings.
— Intermediate packagings are not required if leakproof removable head drums are used as the outer packaging.

b) solid dry

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags paper, kraft plastics textile, sift proof woven plastics, sift proof **Receptacles** fibreboard metal paper plastics wood woven plastics, siftproof	**Not necessary**	**Boxes** fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) plywood (4D) reconstituted wood (4F) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— For **UN 0077, 0132, 0234, 0235 and 0236**, packagings must be lead-free.
— For **UN 0508 and 0509**, metal packagings must not be used. Packagings of other material with a small amount of metal, for example metal closures or other metal fittings such as those mentioned in 6;3, are not considered metal packagings.
— For **UN 0160 and 0161**, when metal drums (1A1, 1A2, 1B1, 1B2, 1N1 or 1N2) are used as the outer packaging, metal packagings must be so constructed that the risk of explosion, by reason of increase in internal pressure from internal or external causes, is prevented.
— For **UN 0160 and 0161**, inner packagings are not required if drums are used as the outer packaging.

Packing Instruction 130

Inner Packagings	Intermediate Packagings	Outer Packagings
Not necessary	**Not necessary**	**Boxes** aluminium (4B) expanded plastics (4H1) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— The following applies to **UN 0006, 0009, 0010, 0015, 0016, 0018, 0019, 0034, 0035, 0038, 0039, 0048, 0056, 0137, 0138, 0168, 0169, 0171, 0181, 0182, 0183, 0186, 0221, 0238, 0243, 0244, 0245, 0246, 0254, 0280, 0281, 0286, 0287, 0297, 0299, 0300, 0301, 0303, 0321, 0328, 0329, 0344, 0345, 0346, 0347, 0362, 0363, 0370, 0412, 0424, 0425, 0434, 0435, 0436, 0437, 0438, 0451, 0459, 0488, 0502 and 0510.** Large and robust explosive articles, normally intended for military use, without their means of initiation or with their means of initiation containing at least two effective protective features, may be carried unpackaged. When such articles have propelling charges or are self-propelled, their ignition systems must be protected against stimuli encountered during normal conditions of transport. A negative result in Test Series 4 on an unpackaged article indicates that the article can be considered for transport unpackaged. Such unpackaged articles may be fixed to cradles or contained in crates or other suitable handling, storage or launching devices in such a way that they will not become loose during normal conditions of transport. Where such large explosive articles are as part of their operational safety and suitability tests subjected to test regimes that meet the intentions of these Technical Standardsand such tests have been successfully undertaken, the appropriate national authority may approve such articles to be transported under these Instructions.

— For **UN 0457, 0458, 0459 and 0460**, whenever loose explosive substances or the explosive substance of an uncased or partly cased article may come into contact with the inner surface of metal packagings (1A2, 1B2, 4A, 4B and metal receptacles), the metal packaging must be provided with an inner liner or coating.

Packing Instruction 131

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Reels**	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plastics, solid (4H2) plywood (4D) reconstituted wood (4F) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) plastics (1H1, 1H2) other metal (1N1, 1N2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— For **UN 0029, 0267 and 0455**, bags and reels must not be used as inner packagings.

Packing Instruction 133

Inner Packagings	Intermediate Packagings	Outer Packagings
Receptacles fibreboard metal plastics wood **Trays, fitted with dividing Partitions** fibreboard plastics wood	**Receptacles** fibreboard metal plastics wood	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— Receptacles are only required as intermediate packagings when the inner packagings are trays.
— For **UN 0043, 0212, 0225, 0268 and 0306**, trays must not be used as inner packagings.

Packing Instruction 134		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags water-resistant **Receptacles** fibreboard metal plastics wood **Sheets** fibreboard, corrugated **Tubes** fibreboard	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) plastics (1H1, 1H2) other metal (1N1, 1N2) plywood (1D) steel (1A1, 1A2)

Packing Instruction 135		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Sheets** paper plastics	**Not necessary**	**Boxes** aluminium (4B) expanded plastics (4H1) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

Packing Instruction 136		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags plastics textile **Boxes** fibreboard plastics wood **Dividing partitions in the outer packagings**	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A)
		Drums aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

Packing Instruction 137		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags plastics **Boxes** fibreboard wood **Tubes** fibreboard metal plastics **Dividing partitions in the outer packagings**	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plastics, solid (4H2) plywood (4D) reconstituted wood (4F) steel (4A)
PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS: — For **UN 0059, 0439, 0440 and 0441**, when the shaped charges are packed singly, the conical cavity must face downwards and the package must be marked as illustrated in Figure 5-29. When the shaped charges are packed in pairs, the conical cavities must face inwards to minimize the jetting effect in the event of accidental initiation.		

Packing Instruction 138

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags plastics	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— If the ends of the articles are sealed, inner packagings are not necessary.

Packing Instruction 139

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags plastics **Receptacles** fibreboard metal plastics wood **Reels** Sheets paper plastics	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— For **UN 0065, 0102, 0104, 0289 and 0290**, the ends of the detonating cord must be sealed, for example by a plug firmly fixed so that the explosive cannot escape. The ends of "**Cord, detonating,** flexible", must be fastened securely.
— For **UN 0065 and 0289,** inner packagings are not required when they are in coils.

Packing Instruction 140

Inner Packagings	Intermediate Packagings	Outer Packagings
Bags plastics Reels Sheets paper, kraft plastics Receptacles wood	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

PARTICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— If the ends of **UN 0105** are sealed, no inner packagings are required.
— For **UN 0101**, the packaging must be siftproof except when the fuse is covered by a paper tube and both ends of the tube are covered with removable caps.
— For **UN 0101**, steel, aluminium or other metal boxes or drums must not be used.

Packing Instruction 141

Inner Packagings	Intermediate Packagings	Outer Packagings
Receptacles fibreboard metal plastics wood **Trays, fitted with dividing partitions** plastics wood Dividing partitions in the outer packagings	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

Packing Instruction 142		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags paper plastics **Receptacles** fibreboard metal plastics wood **Sheets** paper **Trays,** fitted with dividing partitions plastics	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

Packing Instruction 143		
Inner Packagings	**Intermediate Packagings**	**Outer Packagings**
Bags paper, kraft plastics textile textile, rubberized **Receptacles** fibreboard metal plastics wood **Trays, fitted with dividing partitions plastics**	**Not necessary**	**Boxes** aluminium (4B) fibreboard (4G) natural wood, ordinary (4C1) natural wood, with siftproof walls (4C2) other metal (4N) plywood (4D) reconstituted wood (4F) solid plastics (4H2) steel (4A) **Drums** aluminium (1B1, 1B2) fibre (1G) other metal (1N1, 1N2) plastics (1H1, 1H2) plywood (1D) steel (1A1, 1A2)

partICULAR PACKING REQUIREMENTS OR EXCEPTIONS:

— For **UN 0271, 0272, 0415 and 0491**, when metal packagings are used, metal packagings must be so constructed that the risk of explosion, because of increase in internal pressure from internal or external causes, is prevented.
— Instead of the above inner and outer packagings, composite packagings (6HH2) (plastic receptacle with outer solid box) may be used.

Section 4

CLASS 2 – GASES

4.1 SPECIAL PACKING PROVISIONS FOR DANGEROUS GOODS OF CLASS 2

4.1.1 General requirements

4.1.1.1 This section provides general requirements applicable to the use of cylinders and closed cryogenic receptacles for the transport of Class 2 gases (such as UN 1072 **Oxygen, compressed**). Cylinders and closed cryogenic receptacles must be constructed and closed so as to prevent any loss of contents which might be caused under normal conditions of transport, including by vibration, or by changes in temperature, humidity or pressure (resulting from change in altitude, for example).

≠ 4.1.1.2 Segments of cylinders and closed cryogenic receptacles that are in direct contact with dangerous goods must not be affected or weakened by those dangerous goods and must not cause a dangerous effect (such as catalyzing a reaction or reacting with the dangerous goods). In addition to the requirements specified in the relevant packing instruction, which take precedence, the applicable provisions of ISO 11114-1:2020 and ISO 11114-2:2021 must be met.

4.1.1.3 Cylinders and closed cryogenic receptacles, including their closures, must be selected that are able to contain a gas or a mixture of gases according to the requirements of 6;5.1.2 and the requirements of the specific packing instructions of this Segment.

4.1.1.4 Refillable cylinders must not be filled with a gas or gas mixture different from that previously contained unless the necessary operations for change of gas service have been performed. The change of service for compressed and liquefied gases must be in accordance with ISO 11621:1997, as applicable. In addition, a cylinder that previously contained a Class 8 corrosive substance or a substance of another class with a corrosive subsidiary hazard must not be authorized for the transport of a Class 2 substance unless the necessary inspection and testing as specified in 6;5.1.6 have been performed.

4.1.1.5 Prior to filling, the filler must perform an inspection of the cylinder or closed cryogenic receptacle and ensure that the cylinder or closed cryogenic receptacle is authorized for the gas to be transported and that the provisions of these Technical Standardshave been met. Shut-off valves must be closed after filling and remain closed during transport. The shipper must verify that the closures and equipment are not leaking.

4.1.1.6 Cylinders and closed cryogenic receptacles must be filled according to the working pressures, filling ratios and provisions specified in the appropriate packing instruction for the specific substance and taking into account the lowest pressure rating of any component. Service equipment having a pressure rating lower than other components must nevertheless comply with 6;5.1.3.1. Reactive gases and gas mixtures must be filled to a pressure such that if complete decomposition of the gas occurs, the working pressure of the cylinder must not be exceeded.

4.1.1.7 Cylinders and closed cryogenic receptacles, including their closures, must conform to the design, construction, inspection and testing requirements detailed in 6;5. When outer packagings are prescribed, the cylinders must be firmly secured therein. Unless otherwise specified in the detailed packing instructions, one or more inner packagings may be enclosed in an outer packaging.

≠ 4.1.1.8 Valves must be designed and constructed in such a way that they are inherently able to withstand damage without release of the contents or must be protected from damage, which could cause inadvertent release of the contents of the cylinder and closed cryogenic receptacle, by one of the following methods:

a) Valves are placed inside the neck of the cylinder and closed cryogenic receptacle and protected by a threaded plug or cap;

b) Valves are protected by caps or guards. Caps must possess vent holes of a sufficient cross-sectional area to evacuate the gas if leakage occurs at the valves;

c) Valves are protected by shrouds or permanent protective attachments;

d) Not used; or

e) Cylinders and closed cryogenic receptacles are transported in an outer packaging. The packaging as prepared for transport must be capable of meeting the drop test specified in 6;4.3 at the Packing Group I performance level.

≠ For cylinders and closed cryogenic receptacles with valves as described in b), the requirements of:

- **ISO 11117:1998,**
- **ISO 11117:2008 + Cor 1:2009** or
- **ISO 11117:2019** must be met.
- Requirements for shrouds and permanent protective attachments used as valve protection under c) are given in the relevant pressure receptacle shell design standards, see 6;5.2.1.
- Valves with inherent protection used for refillable cylinders must meet the requirements of clause 4.6.2 of **ISO 10297:2006, clause 5.5.2 of ISO 10297:2014, clause 5.5.2 of ISO 10297:2014 + Amd 1:2017 or,**
- in the case of self-closing valves, of clause 5.4.2 of **ISO 17879:2017**.
- For valves with inherent protection used for non-refillable cylinders, the requirements of clause 9.2.5 of **ISO 11118:2015 or of clause 9.2.5 of ISO 11118:2015 + Amd 1:2019 must be met.**

≠ 4.1.1.9 Non-refillable cylinders and closed cryogenic receptacles must:

a) be transported in an outer packaging, such as a box, or crate, or in shrink-wrapped trays or stretch-wrapped trays;

b) be of a water capacity less than or equal to 1.25 L when filled with flammable gas; and

c) not be repaired after being put into service.

4.1.1.10 Refillable cylinders, other than closed cryogenic receptacles, must be periodically inspected according to the provisions of 6;5.1.6 and Packing Instruction 200, 214, 218 or 219. Cylinders and closed cryogenic receptacles must not be filled after they become due for periodic inspection but may be transported after the expiry of the time limit.

4.1.1.11 Repairs must be consistent with the fabrication and testing requirements of the applicable design and construction standards and are only permitted as indicated in the relevant periodic inspection standards specified in 6;5. Cylinders, other than the jacket of closed cryogenic receptacles, must not be subjected to repairs of any of the following:

a) weld cracks or other weld defects;

b) cracks in walls;

c) leaks or defects in the material of the wall, head or bottom.

4.1.1.12 Cylinders and closed cryogenic receptacles must not be offered for filling:

a) when damaged to such an extent that the integrity of the cylinder and closed cryogenic receptacle or its service equipment may be affected;

b) unless the cylinder and closed cryogenic receptacle and its service equipment have been examined and found to be in good working order; or

c) unless the required certification, retest, and filling marks are legible.

4.1.1.13 Filled cylinders and closed cryogenic receptacles must not be offered for transport:

a) when leaking;
b) unless the cylinder and closed cryogenic receptacle and its service equipment have been examined and found to be in good working order; or

c) when damaged to such an extent that the integrity of the cylinder and closed cryogenic receptacle or its service equipment may be affected;

d) unless the required certification, retest, and filling marks are legible.

Packing Instruction 200

For cylinders, the general packing requirements of 4;1.1 and 4;4.1.1 must be met.

Cylinders, constructed as specified in 6;5 are authorized for the transport of a specific substance when specified in the following tables (Table 1 and Table 2). Cylinders other than UN marked and certified cylinders may be used if the design, construction, testing, approval and marks conform to the requirements of the appropriate national authority in which they are approved and filled. The substances contained must be permitted in cylinders and permitted for air transport according to these Instructions. Cylinders for which prescribed periodic tests have become due must not be charged and offered for transport until such retests have been successfully completed. Valves must be suitably protected or must be designed and constructed in such a manner that they are able to withstand damage without leakage as specified in Annex B of ISO 10297:1999. Cylinders with capacities of one litre or less must be packaged in outer packaging constructed of suitable material of adequate strength and design in relation to the packaging capacity and its intended use and secured or cushioned so as to prevent significant movement within the outer packaging during normal conditions of transport. For some substances, the special packing provisions may prohibit a particular type of cylinder. The following requirements must be met:

1) Pressure relief devices must be fitted on cylinders used for the transport of **UN 1013 Carbon dioxide** and **UN 1070 Nitrous oxide**. Other cylinders must be fitted with a pressure relief device if specified by the appropriate national authority of the country of use. The type of pressure relief device, the set to discharge pressure and relief capacity of pressure relief devices, if required, must be specified by the appropriate national authority of the country of use. Manifolding of cylinders is not permitted.

2) The following two tables cover compressed gases (Table 1) and liquefied and dissolved gases (Table 2). They provide:

   a) the UN number, name and description, and classification of the substance;
   b) the LC_{50} for toxic substances;
   c) the types of cylinders authorized for the substance, shown by the letter “X”;
   d) the maximum test period for periodic inspection of the cylinders;
      Note.— For cylinders which make use of composite materials, the maximum test period must be five years. The test period may be extended to that specified in Tables 1 and 2 (that is, up to ten years), if approved by the appropriate national authority of the country of use.
   e) the minimum test pressure of the cylinders;
   f) the maximum working pressure of the cylinders for compressed gases (where no value is given, the working pressure must not exceed two-thirds of the test pressure) or the maximum filling ratio(s) dependent on the test pressure(s) for liquefied and dissolved gases;
   g) special packing provisions that are specific to a substance.

3) In no case must cylinders be filled in excess of the limit permitted in the following requirements:

   a) For compressed gases, the working pressure must be not more than two-thirds of the test pressure of the cylinders. Restrictions to this upper limit on working pressure are imposed by special packing provision “o”. In no case must the internal pressure at 65°C exceed the test pressure.

   b) For high pressure liquefied gases, the filling ratio must be such that the settled pressure at 65°C does not exceed the test pressure of the cylinders.

      The use of test pressures and filling ratios other than those in the table is permitted provided that the above criterion is met, except where special packing provision “o” applies.

      For high pressure liquefied gases and gas mixtures for which relevant data are not available, the maximum filling ratio (FR) must be determined as follows:

      $$FR = 8.5 \times 10^{-4} \times d_g \times P_h$$

      where FR = maximum filling ratio
      d_g = gas density (at 15°C, 1 bar)(in g/l)
      P_h = minimum test pressure (in bar).

      If the density of the gas is unknown, the maximum filling ratio must be determined as follows:

      $$FR = \frac{P_h \times MM \times 10^{-3}}{R \times 338}$$

where FR = maximum filling ratio
P_h = minimum test pressure (in bar)
MM = molecular mass (in g/mol)
R = 8.31451×10^{-2} bar.l/mol.K (gas constant).

For gas mixtures, the average molecular mass is to be taken, taking into account the volumetric concentrations of the various components.

c) For low pressure liquefied gases, the maximum mass of contents per litre of water capacity must equal 0.95 times the density of the liquid phase at 50°C; in addition, the liquid phase must not fill the cylinder at any temperature up to 60°C. The test pressure of the cylinder must be at least equal to the vapour pressure (absolute) of the liquid at 65°C, minus 100 kPa (1 bar).

For low pressure liquefied gases for which filling data is not provided in the table, the maximum filling ratio must be determined as follows:

$FR = (0.0032 \times BP - 0.24) \times d_1$

where FR = maximum filling ratio
BP = boiling point (in Kelvin)
d_1 = density of the liquid at boiling point (in kg/l).

d) For **UN 1001**, **Acetylene, dissolved**, and **UN 3374 Acetylene, solvent free**, see p).

e) For liquefied gases charged with compressed gases, both components – the liquefied gas and the compressed gas – have to be taken into consideration in the calculation of the internal pressure in the cylinder.

The maximum mass of contents per litre of water capacity must not exceed 0.95 times the density of the liquid phase at 50°C; in addition, the liquid phase must not completely fill the cylinder at any temperature up to 60°C.

When filled, the internal pressure at 65°C must not exceed the test pressure of the cylinders. The vapour pressures and volumetric expansions of all substances in the cylinders must be considered. When experimental data is not available, the following steps must be carried out:

i) Calculation of the vapour pressure of the liquefied gas and of the partial pressure of the compressed gas at 15°C (filling temperature);

ii) Calculation of the volumetric expansion of the liquid phase resulting from the heating from 15°C to 65°C and calculation of the remaining volume for the gaseous phase;

iii) Calculation of the partial pressure of the compressed gas at 65°C considering the volumetric expansion of the liquid phase;

Note. — The compressibility factor of the compressed gas at 15°C and 65°C must be considered.

iv) Calculation of the vapour pressure of the liquefied gas at 65°C;

v) Calculation of the total pressure, which is the sum of the vapour pressure of the liquefied gas and the partial pressure of the compressed gas at 65°C;

vi) Consideration of the solubility of the compressed gas at 65°C in the liquid phase.

The test pressure of the cylinder must not be less than the calculated total pressure minus 100 kPa (1bar).

If the solubility of the compressed gas in the liquefied phase is not known for the calculation, the test pressure can be calculated without taking the gas solubility (sub-paragraph (vi)) into account.

4) Gas mixtures containing any of the following gases must not be offered for transport in aluminium alloy cylinders unless approved by the appropriate national authority of the State of Origin and the State of the Operator:

Ethyl chloride **UN 1037**
Methyl chloride **UN 1063**
Refrigerant gas R 40 **UN 1063**
Vinyl bromide, stabilized **UN 1085**
Vinyl chloride, stabilized **UN 1086**
Vinyl fluoride, stabilized **UN 1860**
Methyl chloride and methylene chloride mixture **UN 1912**

5) The filling of cylinders must be carried out by qualified staff using appropriate equipment and procedures. The procedures should include checks of:

a) the conformity of cylinders and accessories with these Instructions;
b) their compatibility with the product to be transported;
c) the absence of damage which might affect safety;
d) compliance with the degree or pressure of filling, as appropriate; and
e) marks and identification.

These requirements are deemed to be met if the following standards are applied:

ISO 10691: 2004 Gas cylinders – Refillable welded steel cylinders for liquefied petroleum gas (LPG) – Procedures for checking before, during and after filling.
ISO 11372: 2011 Gas cylinders – Acetylene cylinders – Filling conditions and filling inspection
ISO 11755: 2005 Gas cylinders – Cylinder bundles for compressed and liquefied gases (excluding acetylene) – Inspection at time of filling
≠ **ISO 13088: 2011** + Amd 1:2020 Gas cylinders – Acetylene cylinder bundles – Filling conditions and filling inspection
ISO 24431:2016 Gas cylinders – Seamless, welded and composite cylinders for compressed and liquefied gases (excluding acetylene) – Inspection at time of filling

6) "Special packing provisions":

Material compatibility

a) Aluminium alloy cylinders are forbidden.
b) Copper valves are forbidden.
c) Metal parts in contact with the contents must not contain more than 65 per cent copper.
d) When steel cylinders or composite cylinders with steel liners are used, only those bearing the "H" mark in accordance with 6;5.2.7.4 p) are permitted.

Gas specific provisions:

l)

- UN 1040 **Ethylene oxide** may also be packed in hermetically sealed glass ampoules or metal inner packagings suitably cushioned in fibreboard, wooden or metal boxes meeting the Packing Group I performance level.
- The maximum quantity permitted in any glass inner packaging is 30 g, and the maximum quantity permitted in any metal inner packaging is 200 g.
- After filling, each inner packaging must be determined to be leak-tight by placing the inner packaging in a hot water bath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55°C is achieved.
- The maximum net mass in any outer packaging must not exceed 2.5 kg.
- When cylinders are used, they must be of the seamless or welded steel types that are equipped with suitable pressure relief devices.
- Each cylinder must be tested for leakage with an inert gas before each refilling and must be insulated with three coats of heat retardant paint or in any equally efficient manner.
- The maximum net quantity per cylinder must not exceed 25 kg.

m) Cylinders must be filled to a working pressure not exceeding 5 bar.

o) In no case must the working pressure or filling ratio shown in the table be exceeded.

p) For **UN 1001 Acetylene, dissolved**, and UN 3374 **Acetylene, solvent free**: cylinders must be filled with a homogeneous monolithic porous mass; the working pressure and the quantity of acetylene must not exceed the values prescribed in the approval or in ISO 3807-1:2000, ISO 3807-2:2000 or ISO 3807:2013, as applicable.

For **UN 1001 Acetylene, dissolved**, cylinders must contain a quantity of acetone or suitable solvent as specified in the approval (see ISO 3807-1:2000, ISO 3807-2:2000 or ISO 3807:2013, as applicable); cylinders fitted with pressure relief devices must be transported vertically.

The test pressure of 52 bar applies only to cylinders fitted with a fusible plug.

ra) Ethyl chloride may be carried in securely sealed glass ampoules (IP.8) containing not more than 5 g of ethyl chloride with a ullage of not less than 7.5 per cent at 21°C. Ampoules must be cushioned with efficient non-combustible material in partitioned cartons with not more than 12 ampoules per carton. The cartons must be tightly packed to prevent movement in wooden boxes (4C1, 4C2), plywood boxes (4D), reconstituted wood boxes (4F), fibreboard boxes (4G) or plastic boxes (4H1, 4H2) that meet the performance testing requirements of 6;4 at the Packing Group II performance level. Not more than 300 g of ethyl chloride is permitted per package.

s) Aluminium alloy cylinders must be:

i) Equipped only with brass or stainless-steel valves; and
ii) Cleaned in accordance with ISO 11621:1997 and not contaminated with oil.

Periodic inspection:

u) The interval between periodic tests may be extended to 10 years for aluminium alloy cylinders when the alloy of the cylinder has been subjected to stress corrosion testing as specified in **ISO 7866:2012 + Cor 1:2014**.

v) The interval between periodic inspections for steel cylinders may be extended to 15 years if approved by the appropriate national authority of the country of use.

Requirements for N.O.S. descriptions and for mixtures:

z) The construction materials of the cylinders and their accessories must be compatible with the contents and must not react to form harmful or dangerous compounds therewith.

The test pressure and filling ratio must be calculated in accordance with the relevant requirements of PI 200.

The necessary steps must be taken to prevent dangerous reactions (that is, polymerization or decomposition) during transport. If necessary, stabilization or addition of an inhibitor may be required.

Note. — For the carriage of oxygen to provide life support to aquatic animals, see Note 7 of the Introductory Notes to this part.

Table 1. COMPRESSED GASES

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m^3	Cylinders	Test pressure, bar*	Test period, years	Maximum working pressure, bar*	Special packing provisions*
1002	**Air, compressed**	2.2			X		10		
1006	**Argon, compressed**	2.2			X		10		
1046	**Helium, compressed**	2.2			X		10		
1049	**Hydrogen, compressed**	2.1			X		10		D
1056	**Krypton, compressed**	2.2			X		10		
1065	**Neon, compressed**	2.2			X		10		
1066	**Nitrogen, compressed**	2.2			X		10		
1071	**Oil gas, compressed**	2.3	2.1		X		5		
1072	**Oxygen, compressed**	2.2	5.1		X		10		S
1954	**Compressed gas, flammable, n.o.s.**	2.1			X		10		Z
1956	**Compressed gas, n.o.s.**	2.2			X		10		Z
1957	**Deuterium, compressed**	2.1			X		10		D
1964	**Hydrocarbon gas mixture, compressed, n.o.s.**	2.1			X		10		Z
1971	**Methane, compressed or natural gas, compressed** with high methane content	2.1			X		10		
2034	**Hydrogen and methane mixture, compressed**	2.1			X		10		
3156	**Compressed gas, oxidizing, n.o.s.**	2.2	5.1		X		10		Z

* Where the entries are blank, the working pressure must not exceed **two-thirds of the test pressure.**

Table 2. LIQUEFIED GASES AND DISSOLVED GASES

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m³	Cylinders	Test pressure, bar*	Test period, years	Filling ratio	Special packing provisions
1001	**Acetylene, dissolved**	2.1			X	60 52	10		c, p
1009	**Bromotrifluoromethane (refrigerant gas R 13b1)**	2.2			X	42 120 250	10	1.13 1.44 1.60	
1010	**Butadienes, stabilized** (1,2-butadiene)	2.1			X	10	10	0.59	
1010	**Butadienes, stabilized** (1,3-butadiene)	2.1			X	10	10	0.55	Z
≠ 1010	**Butadienes and hydrocarbon mixture, stabilized** containing more than 20% butadienes	2.1			X		10		v z
1011	**Butane**	2.1			X	10	10	0.52	V
1012	**Butylene** (butylenes mixture)	2.1			X	10	10	0.50	Z
1012	**Butylene** (1-butylene)	2.1			X	10	10	0.53	
1012	**Butylene** (cis-2-butylene)	2.1			X	10	10	0.55	
1012	**Butylene** (trans-2 butylene)	2.1			X	10	10	0.54	
1013	**Carbon dioxide**	2.2			X	190 250	10	0.68 0.76	
1018	**Chlorodifluoromethane (refrigerant gas R 22)**	2.2			X	27	10	1.03	
1020	**Chloropentafluoroethane (refrigerant gas R 115)**	2.2			X	25	10	1.05	
1021	**1-Chloro-1,2,2,2-tetrafluoroethane (refrigerant gas R 124)**	2.2			X	11	10	1.20	
1022	**Chlorotrifluoromethane (refrigerant gas R 13)**	2.2			X	100 120 190 250	10	0.83 0.90 1.04 1.11	
1027	**Cyclopropane**	2.1			X	18	10	0.55	
1028	**Dichlorodifluoromethane (refrigerant gas R 12)**	2.2			X	16	10	1.15	
1029	**Dichlorofluoromethane (refrigerant gas R 21)**	2.2			X	10	10	1.23	
1030	**1,1-Difluoroethane (Refrigerant gas R 152 a)**	2.1			X	16	10	0.79	
1032	**Dimethylamine, anhydrous**	2.1			X	10	10	0.59	B
1033	**Dimethyl ether**	2.1			X	18	10	0.58	
1035	**Ethane**	2.1			X	95 120 300	10	0.25 0.30 0.40	
1036	**Ethylamine**	2.1			X	10	10	0.61	B
1037	**Ethyl chloride**	2.1			X	10	10	0.80	a, ra
1039	**Ethyl methyl ether**	2.1			X	10	10	0.64	

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m³	Cylinders	Test pressure, bar	Test period year	Filling ratio	Special packing provisions
1041	**Ethylene oxide and carbon dioxide mixture** with more than 9% ethylene oxide but not more than 87%	2.1			X	190 250	10	0.66 .75	
1043	**Fertilizer ammoniating solution** with free ammonia	2.2			X		5		b, z
1055	**Isobutylene**	2.1			X	10	10	0.52	
1058	**Liquefied gases,** non-flammable, charged with nitrogen, carbon dioxide or air	2.2			X		10		
1060	**Methylacetylene and propadiene mixture, stabilized**	2.1			X		10		c, z
1060	**Methylacetylene and propadiene mixture, stabilized** (propadiene with 1% to 4% methylacetylene)	2.1			X	22	10	0.52	C
1061	**Methylamine, anhydrous**	2.1			X	13	10	0.58	B
1063	**Methyl chloride (refrigerant gas R 40)**	2.1			X	17	10	0.81	A
1070	**Nitrous oxide**	2.2	5.1		X	180 225 250	10	0.68 0.74 0.75	
1075	**Petroleum gases, liquefied**	2.1			X		10		v, z
1077	**Propylene**	2.1			X	27	10	0.43	
1078	**Refrigerant gas, n.o.s.**	2.2			X		10		Z
1080	**Sulphur hexafluoride**	2.2			X	70 140 160	10	1.06 1.34 1.38	
1081	**Tetrafluoroethylene, stabilized**	2.1			X	200	10		m, o
1083	**Trimethylamine, anhydrous**	2.1			X	10	10	0.56	B
1085	**Vinyl bromide, stabilized**	2.1			X	10	10	1.37	A
1086	**Vinyl chloride, stabilized**	2.1			X	12	10	0.81	A
1087	**Vinyl methyl ether, stabilized**	2.1			X	10	10	0.67	
1858	**Hexafluoropropylene (refrigerant gas R 1216)**	2.2			X	22	10	1.11	
1860	**Vinyl fluoride, stabilized**	2.1			X	250	10	0.64	A
1912	**Methyl chloride and methylene chloride mixture**	2.1			X	17	10	0.81	A
1952	**Ethylene oxide and carbon dioxide mixture** with not more than 9% ethylene oxide	2.2			X	190 250	10	0.66 0.75	
1958	**1,2-dichloro-1,1,2,2-tetrafluoroethane (refrigerant gas R 114)**	2.2			X	10	10	1.30	
1959	**1,1-difluoroethylene (refrigerant gas R 1132a)**	2.1			X	250	10	0.77	

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m³	Cylinders	Test pressure, bar	Test period, years	Filling ratio	Special packing provisions
1962	**Ethylene**	2.1			X	225 300	10	0.34 0.38	
1965	**Hydrocarbon gas mixture, liquefied, n.o.s.**	2.1			X		10		v, z
1968	**Insecticide gas, n.o.s.**	2.2			X		10		Z
1969	**Isobutane**	2.1			X	10	10	0.49	V
1973	**Chlorodifluoromethane and chloropentafluoroethane mixture** with fixed boiling point, with approximately 49% chlorodifluoromethane **(refrigerant gas R 502)**	2.2			X	31	10	1.01	
1974	**Chlorodifluorobromo-methane (refrigerant gas R 12b1)**	2.2			X	10	10	1.61	
1976	**Octafluorocyclobutane (refrigerant gas R C318)**	2.2			X	11	10	1.32	
1978	**Propane**	2.1			X	23	10	0.43	V
1982	**Tetrafluoromethane (refrigerant gas R 14)**	2.2			X	200 300	10	0.71 0.90	
1983	**1-chloro-2,2,2-trifluoroethane (refrigerant gas R 133a)**	2.2			X	10	10	1.18	
1984	**Trifluoromethane (refrigerant gas R 23)**	2.2			X	190 250	10	0.88 0.96	
2035	**1,1,1-trifluoroethane (refrigerant gas R 143a)**	2.1			X	35	10	0.73	
2036	**Xenon**	2.2			X	130	10	1.28	
2044	**2,2-dimethylpropane**	2.1			X	10	10	0.53	
2073	**Ammonia solution,** relative density less than 0.880 at 15°C in water, with more than 35% but not more than 40% ammonia with more than 40% but not more than 50% ammonia	2.2			 X X	 10 12	 5 5	 0.80 0.77	 B B
2193	**Hexafluoroethane (refrigerant gas R 116)**	2.2			X	200	10	1.13	
2200	**Propadiene, stabilized**	2.1			X	22	10	0.50	
2419	**Bromotrifluoroethylene**	2.1			X	10	10	1.19	
2422	**Octafluorobut-2-ene (refrigerant gas R 1318)**	2.2			X	12	10	1.34	
2424	**Octafluoropropane (refrigerant gas R 218)**	2.2			X	25	10	1.04	
2451	**Nitrogen trifluoride**	2.2	5.1		X	200	10	0.50	
2452	**Ethylacetylene, stabilized**	2.1			X	10	10	0.57	C
2453	**Ethyl fluoride (refrigerant gas R 161)**	2.1			X	30	10	0.57	
2454	**Methyl fluoride (refrigerant gas R 41)**	2.1			X	300	10	0.63	
2517	**1-chloro-1,1-difluoroethane (refrigerant gas R 142b)**	2.1			X	10	10	0.99	

UN No.	Name and description	Class or Division	Subsidiary hazard	LC_{50} ml/m^3	Cylinders	Test pressure, bar	Test period, years	Filling ratio	Special packing provisions
2599	**Chlorotrifluoromethane and trifluoromethane azeotropic mixture** with approximately 60% chlorotrifluoromethane (refrigerant gas R 503)	2.2			X	31 42 100	10	0.12 0.17 0.64	
2601	**Cyclobutane**	2.1			X	10	10	0.63	
2602	**Dichlorodifluoro-methane and difluoroethane azeotropic mixture** with approximately 74% dichlorodifluoromethane (refrigerant gas R 500)	2.2			X	22	10	1.01	
3070	**Ethylene oxide and dichlorodifluoro-methane mixture** with not more than 12.5% ethylene oxide	2.2			X	18	10	1.09	
3153	**Perfluoro(methyl vinyl ether)**	2.1			X	20	10	0.75	
3154	**Perfluoro(ethyl vinyl ether)**	2.1			X	10	10	0.98	
3157	**Liquefied gas, oxidizing, n.o.s.**	2.2	5.1		X		10		Z
3159	**1,1,1,2-tetrafluoroethane (refrigerant gas R 134a)**	2.2			X	18	10	1.05	
3161	**Liquefied gas, flammable, n.o.s.**	2.1			X		10		Z
3163	**Liquefied gas, n.o.s.**	2.2			X		10		Z
3220	**Pentafluoroethane (refrigerant gas R 125)**	2.2			X	49 35	10	0.95 0.87	
3252	**Difluoromethane (refrigerant gas R 32)**	2.1			X	48	10	0.78	
3296	**Heptafluoropropane (refrigerant gas R 227)**	2.2			X	13	10	1.21	
3297	**Ethylene oxide and chlorotetrafluoroethane mixture** with not more than 8.8% ethylene oxide	2.2			X	10	10	1.16	
3298	**Ethylene oxide and pentafluoroethane mixture** with not more than 7.9% ethylene oxide	2.2			X	26	10	1.02	
3299	**Ethylene oxide and tetrafluoroethane mixture** with not more than 5.6% ethylene oxide	2.2			X	17	10	1.03	
3337	**Refrigerant gas R 404a**	2.2			X	36	10	0.82	
3338	**Refrigerant gas R 407a**	2.2			X	32	10	0.94	
3339	**Refrigerant gas R 407b**	2.2			X	33	10	0.93	
3340	**Refrigerant gas R 407c**	2.2			X	30	10	0.95	
3354	**Insecticide gas, flammable, n.o.s.**	2.1			X		10		Z
3374	**Acetylene, solvent free**	2.1			X	60 52	5		c, p

Packing Instruction 201

The general packing requirements of 4;1 must be met.

Small hydrocarbon gas-powered devices, including replacement cartridges, and lighters for cigarettes and lighter refills must comply with the requirements of the country in which they are filled. They must be provided with protection against inadvertent discharge. Lighters must not contain more than 10 g of liquefied petroleum gas. Hydrocarbon gas-powered small devices and lighter refills must not contain more than 65 g of liquefied petroleum gas. The liquid portion of the gas must not exceed 85 per cent of the capacity of the fuel vessel at 15°C. The articles, including closures, must be capable of withstanding an internal pressure of twice the pressure in the fuel vessel at 55°C. Where refill cartridges are in the form of aerosol dispensers, the pressure in the aerosol must not exceed 1 500 kPa at 55°C and the requirements of subparagraphs b) to e) of Packing Instruction 203 must be met. The articles must be tightly packed to prevent inadvertent operation in wooden boxes (4C1, 4C2), plywood boxes (4D), reconstituted wood boxes (4F), fibreboard boxes (4G) or plastic boxes (4H1, 4H2) of Packing Group II. The net quantity of liquefied petroleum gas in each package must not exceed 1 kg on passenger aircraft and 15 kg on cargo aircraft. Articles which meet the above requirements are permitted only when the valve and ignition mechanisms are designed or securely sealed, taped or otherwise fastened to prevent operation or leakage of contents during transport.

Articles permitted under this packing instruction may also include, within the same outer packaging, replacement cartridges exceeding 65 g each, containing liquefied petroleum gas, provided such cartridges comply with all the requirements of Packing Instruction 200, they are not manifolded or connected to the article and they cannot cause the failure or functioning of the article during transport. Such consignments must be carried on cargo aircraft.

Packing Instruction 202

This instruction applies to Class 2 refrigerated liquefied gases in open and closed cryogenic receptacles.

Requirements for closed cryogenic receptacles

1) The general requirements of 4;1 and 4;4.1 must be met.

2) The requirements of 6;5 must be met.

3) The closed cryogenic receptacles must be so insulated that they do not become coated with frost.

4) **Test pressure**

Refrigerated liquids must be filled in closed cryogenic receptacles with the following minimum test pressures:

a) For closed cryogenic receptacles with vacuum insulation, the test pressure must not be less than 1.3 times the sum of the maximum internal pressure of the filled receptacle, including during filling and discharge, plus 100 kPa (1 bar);

b) For other closed cryogenic receptacles, the test pressure must be not less than 1.3 times the maximum internal pressure of the filled receptacle, taking into account the pressure developed during filling and discharge.

≠ 5) **Filling**

For non-flammable, non-toxic refrigerated liquefied gases, the volume of liquid phase at the filling temperature and at a pressure of 100 kPa (1 bar) must not exceed 98 per cent of the water capacity of the pressure receptacle.

6) **Pressure-relief devices**

Every closed cryogenic receptacle, having a nominal capacity in excess of 550 L, must be provided with at least 2 pressure-relief devices. The pressure-relief device must be of the type that will resist dynamic forces including surge.

Closed cryogenic receptacles, having a nominal capacity of 550 L or less, must be provided with at least 1 pressure-relief device, and may in addition have a frangible disc in parallel with the spring loaded device in order to meet the requirements of 6;5.1.3.6.5. The pressure-relief device must be of the type that will resist dynamic forces including surge.

Note.— The pressure-relief devices must meet the requirements of 6;5.1.3.6.4 and 6;5.1.3.6.5.

Packing Instruction 202

7) **Compatibility**

Materials used to ensure the leakproofness of the joints or for the maintenance of the closures must be compatible with the contents. In the case of receptacles intended for the transport of oxidizing gases (that is, with a subsidiary hazard of 5.1), these materials must not react with these gases in a dangerous manner.

8) Periodic inspection

The periodic inspection and test frequencies of pressure relief valves must not exceed five years.

Note.— Insulated packagings containing refrigerated liquid nitrogen fully absorbed in a porous material are not subject to these Technical Standardswhen carried as cargo provided they meet the requirements of Special Provision A152.

Requirements for open cryogenic receptacles

Open cryogenic receptacles must be constructed to meet the following requirements:

1. The receptacles must be designed, manufactured, tested and equipped in such a way as to withstand all conditions, including fatigue, to which they will be subjected during their normal use and during normal conditions of transport.

2. The maximum water capacity for metal receptacles is 50 L and for glass receptacles it is 5 L.

3. The receptacle must have a double wall construction with the space between the inner and outer wall being evacuated (vacuum insulation). The insulation must prevent the formation of hoar frost on the exterior of the receptacle.

4. The materials of construction must have suitable mechanical properties at the service temperature.

5. Materials which are in direct contact with the dangerous goods must not be affected or weakened by the dangerous goods intended to be transported and must not cause a dangerous effect, such as catalysing a reaction or reacting with the dangerous goods.

6. Receptacles of glass double wall construction must have an outer packaging with suitable cushioning or absorbent materials which can withstand the pressures and impacts liable to occur under normal conditions of transport.

7. The receptacle must be designed to remain in an upright position during transport (such as have a base whose smaller horizontal dimension is greater than the height of the centre of gravity when filled to capacity or be mounted on gimbals).

8. Receptacles must be metal or glass vacuum insulated vessels or flasks vented to the atmosphere to prevent any increase in pressure within the package and the openings must be fitted with devices allowing gases to escape, preventing any splashing out of liquid and so configured that they remain in place during transport.

9. Open cryogenic receptacles must bear the following marks permanently affixed, such as by stamping, engraving or etching:

   a) the manufacturer’s name and address;
   b) the model number or name;
   c) the serial or batch number;
   d) the UN number and proper shipping name of gases for which the receptacle is intended; and
   e) the capacity of the receptacle in litres.

Note.— The size of the mark must be as set out for cylinders in SEGMENT 6;5.2.7.1. Open cryogenic receptacles manufactured prior to 1 January 2012 are not required to be so marked.

10. Open cryogenic receptacles are permitted for nitrogen, argon, krypton, neon and xenon refrigerated liquids.

Packing Instruction 203

Passenger and cargo aircraft for UN 1950 and 2037 only

The general packing requirements of 4;1 must be met.

For the purposes of this packing instruction, a receptacle is considered to be an inner packaging.

Note. — "Receptacle" has the same meaning as set out in 1;3. Any reference in this packing instruction to receptacle will include "aerosols" of UN 1950 and "receptacles, small, containing gas" and "gas cartridges" of UN 2037.

Aerosols and receptacles, small, containing gas (gas cartridges) must meet the requirements of SEGMENT

6;5.4. The capacity of metal receptacles must not exceed 1 000 mL; plastics receptacles must not exceed 500

mL.

UN number and name		*Net quantity per package*	
		Cargo	*Passenger*
UN 1950	**Aerosols**, flammable	150	75 kg
UN 1950	**Aerosols**, flammable (engine starting fluid)	150	Forbidden
UN 1950	**Aerosols**, non-flammable	150	75 kg
UN 1950	**Aerosols**, non-flammable (tear gas devices)	50	Forbidden
UN 2037	**Gas cartridges**	15	1 kg
UN 2037	**Receptacles, small, containing gas**	15	1 kg

ADDITIONAL PACKING REQUIREMENTS

— Packagings must meet Packing Group II performance requirements.
— Release valves on aerosols must be protected by a cap or other suitable means to prevent inadvertent release of the contents during normal conditions of air transport.
— Receptacles must be packed so as to prevent excessive movement and inadvertent discharge during normal conditions of transport.

OUTER PACKAGINGS (see 6;3.1)

Drums	**Boxes**
Aluminium (1B2)	Aluminium (4B)
Fibre (1G)	Fibreboard (4G)
Other Metal (1N2)	Natural wood (4C1, 4C2)
Plastics (1H2)	Other metal (4N)
Plywood (1D)	Plastics (4H1, 4H2)
Steel (1A2)	Plywood (4D)
	Steel (4A)
	Reconstituted wood (4F)

Packing Instruction Y203

Passenger and cargo aircraft for UN 1950 and 2037 only

The requirements of 3;4 must be met.

For the purposes of this packing instruction, a receptacle is considered to be an inner packaging.

Note. — "Receptacle" has the same meaning as set out in 1;3. Any reference in this packing instruction to receptacle will include "aerosols" of UN 1950 and "receptacles, small, containing gas" and "gas cartridges" of UN 2037.

Aerosols and receptacles, small, containing gas (gas cartridges) must meet the requirements of SEGMENT

6;5.4. The capacity of metal receptacles must not exceed 1 000 mL; plastics receptacles must not exceed 500

mL.

Non-refillable aerosols and non-refillable receptacles containing gas (gas cartridges) containing toxic substances must not exceed 120 mL capacity.

Name and UN number		*Total gross mass per package*
Aerosols, flammable	**UN 1950**	30 kg G
Aerosols, non-flammable	**UN 1950**	30 kg G
Gas cartridges	**UN 2037**	1 kg
Receptacles, small, containing gas	**UN 2037**	1 kg

ADDITIONAL PACKING REQUIREMENTS

— Release valves on aerosols must be protected by a cap or other suitable means to prevent inadvertent release of the contents during normal conditions of air transport.
— Receptacles must be packed so as to prevent excessive movement and inadvertent discharge during normal conditions of transport.

OUT

Boxes	**Drums**
Aluminium	Aluminium
Fibreboard	Fibre
Natural wood	Other metal
Other metal	Plastics
Plastics	Plywood
Plywood	Steel
Reconstituted wood	
Steel	

Packing Instruction 206

Passenger and cargo aircraft for UN 3167, UN 3168 and UN 3169 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

A gas sample may only be accepted for transport as a non-pressurized gas providing it is at a pressure corresponding to ambient atmospheric pressure at the time the containment system is closed and this must not exceed 105 kPa absolute.

Cylinders and gas receptacles conforming to the construction, testing and filling requirements approved by the appropriate national authority are permitted.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – passenger*	*Total quantity per package – passenger*	*Inner packaging quantity (per receptacle) – cargo*	*Total quantity per package – cargo*	
UN 3167 **Gas sample, non-pressurized, flammable, n.o.s.**	Glass	1.0 L	1.0 L	2.5 L	5.0 L	No
	Metal	1.0 L		2.5 L		
UN 3169 Gas sample, non-pressurized, toxic, n.o.s.	Glass	Forbidden	Forbidden	1.0 L	1.0 L	No
	Metal			1.0 L		
UN 3168 Gas sample, non-pressurized, toxic, flammable, n.o.s.	Glass	Forbidden	Forbidden	1.0 L	1.0 L	No
	Metal			1.0 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS Inner packagings must be hermetically sealed.

— Packagings must meet the Packing Group II performance requirements.
— Inner packaging(s) must be packed so as to prevent movement in the outer packaging.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H,1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 208

The general packing requirements of 4;1 must be met.

Articles, pressurized pneumatic or hydraulic containing a non-flammable, non-liquefied and non-toxic gas and constructed from materials which will not fragment under pressure, may be carried under the following conditions:

a) when installed in construction equipment and assembled machinery, articles must be designed and constructed with a burst pressure of not less than 5 times their charged pressure at 21°C when shipped;

Note. — Labelling, marking, dangerous goods transport documents and information to pilot-in-command are not required.

b) when tightly packed to prevent movement in strong outer packagings and charged to not more than 1 380 kPa at 21°C, the following conditions also apply:

1) each article must have a fluid space not exceeding 41 L under stored pressure;

2) each article must be tested without failure or damage to at least 3 times its charged pressure at 21°C but not less than 830 kPa before initial shipment and before each refilling and re-shipment;

c) when tightly packed to prevent movement in strong outer packagings and charged with a pressure exceeding 1 380 kPa at 21°C the following conditions also apply:

1) each article must have a fluid space not exceeding 41 L under stored pressure;

2) each article must be tested without failure or damage to at least 3 times its charged pressure at 21°C, but not less than 830 kPa before initial shipment and before each refilling and re-shipment;

3) each article must be designed and constructed with a burst pressure of not less than 5 times its charged pressure at 21°C when shipped.

Packing Instruction 211

The general packing requirements of 4;1 must be met.

Refrigerating machines or components containing non-toxic liquefied gases or Ammonia solutions (UN 2672) must meet the following requirements:

a) each cylinder must not contain more than 450 kg of a Division 2.2 gas without subsidiary hazard or 25 kg of Ammonia solutions (UN 2672);

b) machines or components having two or more charged cylinders may not contain an aggregate of more than 910 kg of a Division 2.2 gas without subsidiary hazard or more than 45 kg of Ammonia solutions (UN 2672);

c) each cylinder must be equipped with a safety device meeting the requirements of a recognized national standard;

d) each cylinder must be equipped with a shut-off valve at each opening except openings used for safety devices and with no other connection. These valves must be closed prior to and during transport;

e) cylinders must be manufactured, inspected and tested in accordance with a recognized UN or national standard;

f) all parts subject to refrigerant pressure during shipment must be tested in accordance with a recognized UN or national standard;

g) the liquid portion of the refrigerant, if any, must not completely fill any pressure vessel at 55°C;

h) the amount of refrigerant, if liquefied, must not exceed the filling density prescribed by applicable State regulations.

Packing Instruction 213

The general packing requirements of 4;1 must be met.

Fire extinguishers with compressed or liquefied gas must be packed in strong outer packagings so that they cannot be accidentally activated.

Fire extinguishers may include installed actuating cartridges (cartridges, power device of Division 1.4C or 1.4S), without changing the classification of Division 2.2, provided the total quantity of deflagrating (propellant) explosives does not exceed 3.2 g per extinguishing unit.

Large fire extinguishers may also be transported unpackaged provided that the requirements of S-4;3.1.2 a) to e) are met, the valves are protected by one of the methods in accordance with 4;4.1.1.8 a) to c) and other equipment mounted on the fire extinguisher is protected to prevent accidental activation. For the purpose of this packing instruction, “large fire extinguishers” means fire extinguishers as described in sub-paragraphs c) to e) of Special Provision A19.

Packing Instruction 214

Cargo aircraft only for UN 3468 only

This Instruction applies to storage systems containing hydrogen absorbed in a metal hydride (UN 3468) individually or when contained in equipment and apparatus when transported on cargo aircraft.

1) For metal hydride storage systems, the general packing requirements of 4;4.1 must be met.

2) Only cylinders not exceeding 150 L in water capacity and having a maximum developed pressure not exceeding 25 MPa are covered by this packing instruction.

3) Metal hydride storage systems meeting the applicable requirements of 6;5 for the construction and testing of cylinders containing gas may be used for the transport of hydrogen only.

4) When steel cylinders or composite cylinders with steel liners are used, only those bearing the “H” mark, in accordance with 6;5.2.9.2 j) are permitted.

5) Metal hydride storage systems must meet the service conditions, design criteria, rated capacity, type tests, batch tests, routine tests, test pressure, rated charging pressure and provisions for pressure relief devices for transportable metal hydride storage systems specified in ISO 16111:2008 or ISO 16111:2018, and their conformity and approval must be assessed in accordance with 6;5.2.5.

6) Metal hydride storage systems must be filled with hydrogen at a pressure not exceeding the rated charging pressure shown in the permanent mark on the system as specified in ISO 16111:2008 or ISO 16111:2018.

7) The periodic test requirements for a metal hydride storage system must be in accordance with ISO 16111:2008 or ISO 16111:2018 and carried out in accordance with 6;5.2.6, and the interval between periodic inspections must not exceed five years. See 6;5.2.4.2 to determine which standard is applicable at the time of periodic inspection and test.

8) Storage systems with a water capacity of less than 1 L must be packaged in rigid outer packagings constructed of suitable material of adequate strength and design in relation to the packaging capacity and its intended use. They must be adequately secured or cushioned so as to prevent damage during normal conditions of transport.

9) Maximum net quantity per package for cargo aircraft is 100 kg of metal hydride storage systems, including when such storage systems are packed with equipment or contained in equipment.

Packing Instruction 215

Passenger and cargo aircraft for UN 3478 and 3479 only

General requirements

SEGMENT 4;1.1.1, 1.1.2 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3478 **Fuel cell cartridges** containing liquefied flammable gas UN 3479 **Fuel cell cartridges** containing hydrogen in metal hydride	15 kg of fuel cell cartridges	1 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Plastics (1H2)	Steel (3A2)
Other metal (4N)	Plywood (1D)	
Plastics (4H1, 4H2)	Steel (1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y215

Limited quantities for UN 3478 and 3479 only

General requirements

SEGMENT 3;4 requirements must be met.

Single packagings are not permitted for limited quantities.

For the purpose of this packing instruction, a fuel cell cartridge is considered an inner packaging.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Maximum quantity per package*
UN 3478 **Fuel cell cartridges** containing liquefied flammable gas UN 3479 **Fuel cell cartridges** containing hydrogen in metal hydride	0.5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Fuel cell cartridges must not exceed 120 ml water capacity each.

Packing Instruction Y215

OUTER PACKAGINGS

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Plastics	Steel
Other metal	Plywood	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 216

Passenger and cargo aircraft for UN 3478 and 3479 (contained in equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3478 **Fuel cell cartridges contained in equipment,** containing liquefied flammable gas UN 3479 **Fuel cell cartridges contained in equipment,** containing hydrogen in metal hydride	15 kg of fuel cell cartridges	1 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges that are contained in equipment must be protected against short circuit and the equipment must be protected against inadvertent operation.
— Equipment must be securely cushioned in the outer packagings.
— Fuel cell systems must not charge batteries during transport.
— On passenger aircraft, each fuel cell system and each fuel cell cartridge must conform to IEC 62282-6-100 Ed. 1, including Amendment 1, or a standard approved by the appropriate authority of the State of Origin.

OUTER PACKAGINGS

Boxes	*Drums*	*Jerricans*
Strong outer packagings		

Packing Instruction 217

Passenger and cargo aircraft for UN 3478 and 3479 (packed with equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3478 **Fuel cell cartridges packed with equipment,** containing liquefied flammable gas UN 3479 **Fuel cell cartridges packed with equipment,** containing hydrogen in metal hydride	15 kg of fuel cell cartridges	1 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— When fuel cell cartridges are packed with equipment, they must be packed in intermediate packagings together with the equipment they are capable of powering.
— The maximum number of fuel cell cartridges in the intermediate packaging must be the minimum number required to power the equipment, plus 2 spares.
— The fuel cell cartridges and the equipment must be packed with cushioning material or divider(s) or inner packaging so that the fuel cell cartridges are protected against damage that may be caused by the movement or placement of the equipment and the cartridges within the packaging.

OUTER PACKAGINGS

Boxes	*Drums*	*Jerricans*
Strong outer packagings		

Packing Instruction 218

General requirements

The general requirements of 4;4.1 applicable to cylinders must be met. Cylinders, constructed as specified in 6;5 are authorized for the transport of UN 3500, UN 3501, UN 3502, UN 3503, UN 3504 and UN 3505. Cylinders other than UN marked and certified cylinders may be used if the design, construction, testing, approval and marks conform to the requirements of the appropriate national authority of the State in which they are approved and filled. The substances contained must be permitted in cylinders and permitted for air transport according to these Instructions. Cylinders for which prescribed periodic tests have become due must not be charged and offered for transport until such retests have been successfully completed.

Compatibility requirements

— The construction materials of the cylinders and their accessories must be compatible with the contents and must not react to form harmful or dangerous compounds therewith.
— The necessary steps must be taken to prevent dangerous reactions (that is, polymerization or decomposition) during transport. If necessary, stabilization or addition of an inhibitor may be required.

Periodic inspection

— The maximum test period for periodic inspection of the cylinders must be 5 years.

ADDITIONAL PACKING REQUIREMENTS

a) Cylinders must be so filled that at 50°C the non-gaseous phase does not exceed 95% of their water capacity, and they are not completely filled at 60°C. When filled, the internal pressure at 65°C must not exceed the test pressure of the cylinders. The vapour pressures and volumetric expansion of all substances in the cylinders must be taken into account.
b) Spray application equipment (such as a hose and wand assembly) must not be connected during transport.
c) The minimum test pressure must be in accordance with Packing Instruction 200 for the propellant but must not be less than 20 bar.
≠ d) Non-refillable cylinders used may have a water capacity in litres not exceeding 1 000 L divided by the test pressure expressed in bars provided capacity and pressure restrictions of the construction standard comply with clause 1 of ISO 11118:2015 + Amd 1:2019, which limits the maximum capacity to 50 L.
e) For liquids charged with a compressed gas, both components – the liquid and the compressed gas – have to be taken into consideration in the calculation of the internal pressure in the cylinder. When experimental data is not available, the following steps must be carried out:

   i) **Calculation of the vapour pressure** of the liquid and of the partial pressure of the compressed gas at 15°C (filling temperature);

   ii) **Calculation of the volumetric expansion** of the liquid phase resulting from the heating from 15°C to 65°C and calculation of the remaining volume for the gaseous phase;

   iii) **Calculation of the partial pressure** of the compressed gas at 65°C considering the volumetric expansion of the liquid phase;

   Note. — The compressibility factor of the compressed gas at 15°C and 65°C must be considered.

   iv) **Calculation of the vapour pressure** of the liquid at 65°C;

   v) **Calculation of the total pressure**, which is the sum of the vapour pressure of the liquid and the partial pressure of the compressed gas at 65°C;

   vi) Consideration of the solubility of the compressed gas at 65°C in the liquid phase.

   The test pressure of the cylinders must not be less than the calculated total pressure minus 100 kPa (1 bar).

   If the solubility of the compressed gas in the liquid phase is not known for the calculation, the test pressure can be calculated without taking the gas solubility (sub-paragraph vi)) into account.
f) For fire extinguishing agents assigned to UN 3500, the maximum test period for periodic inspection must be ten years.

Packing Instruction 218

OUTER PACKAGINGS

Boxes	Drums	Jerricans
Strong outer packagings		

Packing Instruction 219

For cylinders, the general packing requirements of 4;1.1 and 4;4.1.1 must be met.

This Instruction applies to Class 2 adsorbed gases.

1) The following packagings are permitted provided the general packing requirements of 4.1.1 are met:

   a) Cylinders constructed as specified in 6;5.2 and in accordance with ISO 11513:2011, ISO 11513:2019, ISO 9809-1:2010 or ISO 9809-1:2019; and

   b) Cylinders constructed before 1 January 2016 in accordance with 6;5.3 and a specification approved by the appropriate national authorities of the countries of transport and use.

2) The pressure of each filled cylinder must be less than 101.3 kPa at 20°C and less than 300 kPa at 50°C.

3) The minimum **test pressure** of the cylinder is 21 bar.

4) The minimum **burst pressure** of the cylinder is 94.5 bar.

5) The **internal pressure at 65°C** of the filled cylinder must not exceed the test pressure of the cylinder.

6) The adsorbent material must be compatible with the cylinder and must not form harmful or dangerous compounds with the gas to be adsorbed. The gas in combination with the adsorbent material must not affect or weaken the cylinder or cause a dangerous reaction (such as a catalyzing reaction).

7) The quality of the adsorbent material must be verified at the time of each fill to assure the pressure and chemical stability requirements of this packing instruction are met each time an adsorbed gas package is offered for transport.

8) The adsorbent material must not meet the criteria of any of the classes or divisions in these Instructions.

9) The filling procedure must be in accordance with Annex A of ISO 11513:2011 (applicable until 31 December 2024) or Annex A of ISO 11513:2019.

10) The maximum period for periodic inspections is five years.

11) The construction materials of the cylinders and their accessories must be compatible with the contents and must not react to form harmful or dangerous compounds therewith.

UN number and proper shipping name		*Quantity – Cargo*	*Quantity – Passenger*
UN 3529	**Engine, internal combustion, flammable gas powered** or **Machinery, internal combustion, flammable gas powered** or **Engine, fuel cell, flammable gas powered** or **Machinery, fuel cell, flammable gas powered**	No Limit	Forbidden

Packing Instruction 220

Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

≠ 1) If spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries are installed:

   i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

   ii) lithium batteries must meet the provisions of SEGMENT 2;9.3, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in SEGMENT III, subsection 38.3 of the UN Manual of Tests and Criteria may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

≠ 3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Other operational equipment

1) Dangerous goods required for the operation or safety of the machine or equipment, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the machine or equipment.

Internal combustion or fuel cell engine shipped separately (not installed)

1) When internal combustion engines or fuel cell engines are being shipped separately, all fuel, coolant or hydraulic systems remaining in or on the engine must be drained as far as practicable and all disconnected fluid pipes must be sealed with leakproof caps, which are positively retained.

2) This requirement also applies to machines or equipment containing internal combustion engines or fuel cell engines which are being shipped in a dismantled state such that fuel lines have been disconnected.

Packing Instruction 222

Passenger and cargo aircraft for UN 3538 only

Introduction

This packing instruction is only permitted for articles which do not have an existing proper shipping name and which contain only gases of Division 2.2 without a subsidiary hazard, but excluding refrigerated liquefied gases and gases forbidden for transport on passenger aircraft, where the quantity of the Division 2.2 gas exceeds the quantity limits for UN 3363 as prescribed in Packing Instruction 962. In addition to the Division 2.2 gas, the article may also contain lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable.

General requirements

SEGMENT 4;1.1.1, 4;1.1.3, 4;1.1.12 and 4;2 requirements must be met.

UN number and proper shipping name	*Maximum net quantity of gas – Cargo*	*Maximum net quantity of gas – Passenger*
UN 3538 **Articles containing non-flammable, non-toxic gas, n.o.s.***	150 kg	75 kg

ADDITIONAL PACKING REQUIREMENTS

— Packagings must meet the Packing Group II performance requirements.
— Receptacles within articles containing gases must meet the requirements of 4;4.1.1 and 6;5 as appropriate or meet a national or regionally recognized pressure receptacle standard such as the European Pressure Equipment Directive (2014/68/EU) or ASME Section VII,Div.1 R that is capable of providing an equivalent level of protection as Packing Technical Standards200 or 219.
— Articles must be packed to prevent movement and inadvertent operation during normal conditions of transport.

ROBUST ARTICLES

Robust articles may alternatively be transported in strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packaging capacity and its intended use. The packagings must achieve a level of protection that is at least equivalent to that provided by 6;1. Articles may be transported unpackaged or on pallets when the dangerous goods are afforded equivalent protection by the article in which they are contained. In such cases the additional requirement related to Packing Group II performance requirements and the requirement for UN specification packagings do not apply.

OUTER PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Section 5

CLASS 3 – FLAMMABLE LIQUIDS

5.1 PACKING INSTRUCTIONS

Packing Technical StandardsY340 – Y344

Limited quantities
Passenger and cargo aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

- SEGMENT 3, Section 4 requirements must be met, including:
  - the capability of the package to pass a 1.2 m drop test;
  - a 24-hour stacking test; and
  - inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y340	II	Metal	0.5 L	0.5 L	30 kg	No
		Plastics	0.5 L			
		Glass	0.5 L			
Y341	II	Metal	0.5 L	1.0 L		No
		Plastics	0.5 L			
		Glass	0.5 L			
Y342	III	Metal	1.0 L	1.0 L		No
		Plastics	1.0 L			
		Glass	1.0 L			
Y343	III	Metal	1.0 L	2.0 L		No
		Plastics	1.0 L			
		Glass	1.0 L			
Y344	III	Metal	5.0 L	10.0 L		No
		Plastics	5.0 L			
		Glass	2.5 L			

Packing Technical StandardsY340 – Y344

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
350	I	Metal	0.5 L	0.5 L	No
		Plastics	Forbidden		
		Glass	0.5 L		
351	I	Metal	1.0 L	1 L	No
		Plastics	Forbidden		
		Glass	1.5 L		
352	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
353	II	Metal	5.0 L	5 L	No
		Plastics	5.0 L		
		Glass	1.0 L		
354	III	Metal	5.0 L	5 L	5 L
		Plastics	5.0 L		
		Glass	2.5 L		
355	III	Metal	10.0 L	60 L	60 L
		Plastics	10.0 L		
		Glass	2.5 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

Packing Group III

— Packagings must meet the Packing Group II performance requirements if the substance has a Class 8 subsidiary hazard.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements if the substance has a Class 8 subsidiary hazard.

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 354 OR PI 355)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
360	I	Metal	2.5 L	2.5 L	2.5 L
		Plastics	Forbidden		
		Glass	1.0 L		
361	I	Glass	5.0 L	30 L	30 L
		Plastics	Forbidden		
		Metal	1.0 L		
362	II	Metal	1.0 L	5 L	5 L
		Plastics	1.0 L		
		Glass	1.0 L		
363	II	Metal	5.0 L	5 L	5 L
		Plastics	2.5 L		
		Glass	2.5 L		
364	II	Metal	10.0 L	60 L	60 L
		Plastics	5.0 L		
		Glass	2.5 L		
365	III	Metal	25.0 L	60 L	60 L
		Plastics	10.0 L		
		Glass	5.0 L		
366	III	Metal	25.0 L	220 L	220 L
		Plastics	10.0 L		
		Glass	5.0 L		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Other metal (3N2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
Other metal (4N)	Plywood (1D)	Steel (3A1, 3A2)
Plastics (4H1, 4H2)	Plastics (1H1, 1H2)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

For UN 1308

For Packing Groups I and II, only combination packagings are permitted. The completed package must not have a gross mass exceeding 75 kg.

Packing Group III

— Packagings must meet the Packing Group II performance requirements if the substance has a Class 8 subsidiary hazard.

SINGLE PACKAGINGS FOR PACKING GROUP I

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1)	Aluminium (3B1)
		Other metal (1N1)	Steel (3A1)
		Steel (1A1)	

SINGLE PACKAGINGS FOR PACKING GROUP II

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1)	Aluminium (3B1)
		Other metal (1N1)	Plastics (3H1)
		Plastics (1H1)	Steel (3A1)
		Steel (1A1)	

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Instruction 370

Passenger and cargo aircraft for UN 3269 (Packing Group II or III) only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing conditions	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – for liquid base material*	*Inner packaging quantity (per receptacle) – for solid activator*	*Inner packaging quantity (per receptacle) – for liquid activator*	*Total quantity per package*	
Activator (Organic peroxide)	Plastics*	n/a	125 mL	500 g	5 kg	No
	Metal*	n/a	125 mL	500 g		
Base material Class 3 Packing Group II	Metal	5.0 L	n/a	n/a		
	Plastics	5.0 L	n/a	n/a		
	Glass	1.0 L	n/a	n/a		
Activator (Organic peroxide)	Plastics*	n/a	125 mL	500 g	10 kg	No
	Metal*	n/a	125 mL	500 g		
Base material Class 3 Packing Group III	Metal	10.0 L	n/a	n/a		
	Plastics	10.0 L	n/a	n/a		
	Glass	2.5 L	n/a	n/a		

*Including tubes.

The total quantity of kits per package is to be calculated on a one-to-one basis of their volume, that is, 1 L equal to 1 kg.

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

The components may be placed in the same outer packaging provided that they will not interact dangerously in the event of leakage (see 4;1.1.7).

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS							SINGLE PACKAGINGS
Packing conditions	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – for liquid base material*	*Inner packaging quantity (per receptacle) – for liquid activator*	*Inner packaging quantity (per receptacle) – for solid activator*	*Total quantity per package*	*Total gross mass per package*	
Activator (Organic peroxide)	Metal*	n/a	30 mL	100 g	1 kg	30 kg	No
	Plastics*	n/a	30 mL	100 g			
Base material Class 3 Packing Group II	Metal	1.0 L	n/a	n/a			
	Plastics	1.0 L	n/a	n/a			
	Glass	1.0 L	n/a	n/a			
Activator (Organic peroxide)	Metal*	n/a	30 mL	100 g	5 kg		
	Plastics*	n/a	30 mL	100 g			
Base material Class 3 Packing Group III	Metal	5.0 L	n/a	n/a			
	Plastics	5.0 L	n/a	n/a			
	Glass	2.5 L	n/a	n/a			

*Including tubes.

The total quantity of kits per package is to be calculated on a one-to-one basis of their volume, that is, 1 L equal to 1 kg.

Packing Instruction Y370

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – passenger*	*Total quantity per package – cargo*	
UN 1204 **Nitroglycerin solution in alcohol** with not more than 1% nitroglycerin (Packing Group II)	Metal	1.0 L	5 L	60 L	No
	Plastics	1.0 L			
	Plastic	1.0 L			
UN 3064 **Nitroglycerin solution in alcohol** with more than 1% but not more than 5% nitroglycerin (Packing Group II)	Metal	1.0 L	Forbidden	5 L	No

Packing Instruction 371

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 372

Cargo aircraft only for UN 3165 only

General requirements

≠ The requirements of SEGMENT 4;1.1.1, 4;1.1.5; 4;1.1.8 and 4;1.1.10 must be met.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

>

ADDITIONAL PACKING REQUIREMENTS

UN 3165 **Aircraft hydraulic power unit fuel tank** (containing a mixture of anhydrous hydrazine and methyl hydrazine) (M86 fuel) and designed for installation as complete units in aircraft are acceptable, subject to either of the following conditions:

a) the unit must consist of an aluminium pressure receptacle made from tubing and having welded heads. Primary containment of the fuel within this receptacle must consist of a welded aluminium bladder having a maximum internal volume of 46 L. The outer receptacle must have a minimum design gauge pressure of 1 275 kPa and a minimum burst gauge pressure of 2 755 kPa. Each receptacle must be leak-checked during manufacture and before shipment and must be found leakproof. The complete inner unit must be securely packed in non-combustible cushioning material, such as vermiculite, in a strong outer tightly closed metal packaging which will adequately protect all fittings. Maximum quantity of fuel per primary containment and package is 42 L; or

b) the unit must consist of an aluminium pressure receptacle. Primary containment of the fuel within this receptacle must consist of a welded hermetically sealed fuel compartment with an elastomeric bladder having a maximum internal volume of 46 L. The pressure receptacle must have a minimum design gauge pressure of 2 860 kPa and a minimum burst gauge pressure of 5 170 kPa. Each receptacle must be leak-checked during manufacture and before shipment and must be found leakproof. The complete inner unit must be securely packed in non-combustible cushioning material, such as vermiculite, in a strong outer tightly closed metal packaging which will adequately protect all fittings. Maximum quantity of fuel per primary containment and package is 42 L.

Note.— This packing instruction is the same as UN packing instruction P301.

Packing Instruction 373

Passenger and cargo aircraft for UN 1228 (Packing Group II or III) only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS							SINGLE PACKAGINGS	
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – passenger*	*Inner packaging quantity (per receptacle) – cargo*	*Total quantity per package – passenger*	*Total quantity per package – cargo*	*Passenger*	*Cargo*
UN 1228 **Mercaptans, liquid, flammable, toxic, n.o.s.***	II	Metal	Forbidden	5.0 L	Forbidden	60 L	No	60 L
		Plastics		5.0 L				
		Glass		5.0 L				
	III	Metal	1.0 L	5.0 L	5 L	220 L	No	220 L
		Plastics	1.0 L	5.0 L				
		Glass	1.0 L	5.0 L				

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Glass inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS

Boxes	***Drums***	***Jerricans***
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY

Composites	**Cylinders**	**Drums**	**Jerricans**
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Instruction Y373

Limited quantities
Passenger and cargo aircraft for UN 1228 (Packing Group III) only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met, including:

— the capability of the package to pass a 1.2 m drop test;
— a 24-hour stacking test; and
— inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
UN 1228 **Mercaptans, liquid, flammable, toxic, n.o.s.***	III	Metal	0.5 L	1 L	30 kg	No
		Plastics	0.5 L			
		Glass	0.5 L			

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Glass inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 374

Passenger and cargo aircraft for UN 3473 only

General requirements

SEGMENT 4;1.1.1, 1.1.2 and 1.1.8 requirements must be met, including:

1) Compatibility requirements

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3473 **Fuel cell cartridges**	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Steel (3A2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Aluminium (3B2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y374

Limited quantities for UN 3473 only

General requirements

SEGMENT 3;4 requirements must be met.

Single packagings are not permitted for limited quantities.

For the purpose of this packing instruction, a fuel cell cartridge is considered an inner packaging.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Maximum quantity per package*
UN 3473 **Fuel cell cartridges**, containing flammable liquids	2.5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Fuel cell cartridges must not exceed 0.5 L of flammable liquid fuel per cartridge.

Packing Instruction Y374

OUTER PACKAGINGS

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 375

Passenger and cargo aircraft for UN 3473 (contained in equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3473 **Fuel cell cartridges contained in equipment**	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges that are contained in equipment must be protected against short circuit and the equipment must be protected against inadvertent operation.
— Equipment must be securely cushioned in the outer packagings.
— Fuel cell systems must not charge batteries during transport.
— On passenger aircraft, each fuel cell system and each fuel cell cartridge must conform to IEC 62282-6-100 Ed. 1, including Amendment 1, or a standard approved by the appropriate authority of the State of Origin.

OUTER PACKAGINGS

Boxes	***Drums***	***Jerricans***
Strong outer packagings		

Packing Instruction 376

Passenger and cargo aircraft for UN 3473 (packed with equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity — Cargo*	*Quantity — Passenger*
UN 3473 **Fuel cell cartridges packed with equipment**	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— When fuel cell cartridges are packed with equipment, they must be packed in intermediate packagings together with the equipment they are capable of powering.
— The maximum number of fuel cell cartridges in the intermediate packaging must be the minimum number required to power the equipment, plus 2 spares.
— The fuel cell cartridges and the equipment must be packed with cushioning material or divider(s) or inner packaging so that the fuel cell cartridges are protected against damage that may be caused by the movement or placement of the equipment and the cartridges within the packaging.

OUTER PACKAGINGS

Boxes	**Drums**	**Jerricans**
Strong outer packagings		

Packing Instruction 377

Cargo aircraft only for Chlorosilanes

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				**SINGLE PACKAGINGS**
UN number	*Inner packaging (see 6;3.2)*	*Net quantity per inner packaging*	*Total quantity per package*	
UN 1162, UN 1196, UN 1250, UN 1298, UN 1305, UN 2985	Steel	5.0 L	5.0 L	5.0 L
	Plastics	Forbidden		
	Glass	1.0 L		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS

Boxes	**Drums**
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

SINGLE PACKAGINGS

Composites	**Cylinders**	**Drums**	**Jerricans**
Plastic receptacle in steel drum (6HA1)	Steel (as permitted by 4;2.7)	Steel (1A1)	Steel (3A1)

Packing Instruction 378

Passenger and cargo aircraft for UN 3528 only
(See Packing Instruction 220 for flammable gas-powered engines or machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

General requirements

Segment 4, Section 1 requirements must be met, including:

Compatibility requirements

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name		*Quantity – Cargo*	*Quantity – Passenger*
UN 3528	**Engine, internal combustion, flammable liquid powered** or **Machinery, internal combustion, flammable liquid powered** or **Engine, fuel cell, flammable liquid powered** or **Machinery, fuel cell, flammable liquid powered**	No limit	No limit

General

1) The engine or machinery, including the means of containment containing dangerous goods, must be in compliance with the construction requirements specified by the appropriate national authority;

2) Any valves or openings (such as venting devices) must be closed during transport;

3) The engines or machinery must be oriented to prevent inadvertent leakage of dangerous goods and secured by means capable of restraining the engines or machinery to prevent any movement during transport which would change the orientation or cause them to be damaged.

ADDITIONAL PACKING REQUIREMENTS

If the engine or machinery is constructed and designed so that the means of containment containing the dangerous goods affords adequate protection, an outer packaging is not required. Dangerous goods in engines or machinery must otherwise be packed in outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, and meeting the applicable requirements of 4;1.1.1, or they must be fixed in such a way that they will not become loose during normal conditions of transport, such as in cradles or crates or other handling devices.

Flammable liquid fuel tanks

Except as otherwise provided for in this packing instruction, fuel tanks must be drained of fuel and tank caps fitted securely. Special precautions are necessary to ensure complete drainage of the fuel system of machines or equipment incorporating internal combustion engines, such as lawn mowers and outboard motors, where such machines or equipment could possibly be handled in other than an upright position. When it is not possible to handle in other than an upright position, machinery must be drained of fuel as far as practicable, and if any fuel remains, it must not exceed one-quarter of the tank capacity.

Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

≠ 1) If spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries are installed:

   i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

   ii) lithium batteries must meet the provisions of SEGMENT 2;9.3, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in PARTIII, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

≠ 3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Packing Instruction 378

Other operational equipment

Dangerous goods required for the operation or safety of the machine or equipment, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the machine or equipment.

Internal combustion or fuel cell engine shipped separately (not installed)

1) When internal combustion engines or fuel cell engines are being shipped separately, all fuel, coolant or hydraulic systems remaining in or on the engine must be drained as far as practicable and all disconnected fluid pipes must be sealed with leakproof caps, which are positively retained.

2) This requirement also applies to vehicles containing internal combustion engines or fuel cell engines which are being shipped in a dismantled state such that fuel lines have been disconnected.

Section 6

CLASS 4 – FLAMMABLE SOLIDS; SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION; SUBSTANCES WHICH, IN CONTACT WITH WATER, EMIT FLAMMABLE GASES

6.1 GENERAL REQUIREMENTS FOR SELF-REACTIVE SUBSTANCES

Packagings for self-reactive substances must conform to the requirements of 6;1, 6;2, 6;3 and 6;4 and must meet the test requirements of 6;4 for Packing Group II.

6.2 PACKING INSTRUCTIONS

Packing Technical StandardsY440 – Y443

Limited quantities
Passenger and cargo aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

- SEGMENT 3, Section 4 requirements must be met, including:
  - the capability of the package to pass a 1.2 m drop test; and
  - a 24-hour stacking test.

Packing Technical StandardsY440 – Y443

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y440	II	Metal	0.5 kg	1 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y441	II	Metal	0.5 kg	5 kg		No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y442	III	Metal	1.0 kg	5 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			
Y443	III	Metal	1.0 kg	10 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Plastics	Steel
Other metal	Plywood	
Plastics	Other metal	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Technical Standards445 – 446

Passenger aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
—	I	Forbidden *(only permitted for wetted explosives, see Packing Instruction 451)*			
445	II	Metal	2.5 kg	15 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
446	III	Metal	10.0 kg	25 kg	No
		Plastics	10.0 kg		
		Glass	5.0kg		
		Plastic bag	5.0 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
—	I	Forbidden *(only permitted for wetted explosives, see Packing Instruction 451)*			
448	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
449	III	Metal	10.0 kg	100 kg	100 kg
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Technical Standards448 – 449

SINGLE PACKAGINGS

Boxes	Composites	Cylinders	Drums	Jerricans
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C2)			Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)			Plastics (1H1, 1H2)	
Plywood (4D)			Plywood (1D)	
Plastics (4H2)			Steel (1A1, 1A2)	
Reconstituted wood (4F)				
Steel (4A)				

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing conditions	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – for solid base material*	*Inner packaging quantity (per receptacle) – for liquid activator*	*Inner packaging quantity (per receptacle) – for solid activator*	*Total quantity per package*	
Activator (Organic peroxide)	Plastics*	n/a	125 mL	500 g	5 kg	No
	Metal*	n/a	125 mL	500 g		
Base material Division 4.1 Packing Group II	Metal	5.0 kg	n/a	n/a		
	Plastics	5.0 kg	n/a	n/a		
	Glass	1.0 kg	n/a	n/a		
Activator (Organic peroxide)	Plastics*	n/a	125 mL	500 g	10 kg	No
	Metal*	n/a	125 mL	500 g		
Base material Division 4.1 Packing Group III	Metal	10.0 kg	n/a	n/a		
	Plastics	10.0 kg	n/a	n/a		
	Glass	2.5kg	n/a	n/a		

*Including tubes.

The total quantity of kits per package is to be calculated on a one-to-one basis of their volume, that is, 1 L equal to 1 kg.

Packing Instruction 450

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

The components may be placed in the same outer packaging provided that they will not interact dangerously in the event of leakage (see 4;1.1.7).

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4A, 4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y450

Limited quantities
Passenger and cargo aircraft for UN 3527 (Packing Group II or III) only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

- SEGMENT 3, Section 4 requirements must be met, including:
  - the capability of the package to pass a 1.2 m drop test;
  - a 24-hour stacking test; and
  - inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

Packing Instruction Y450

COMBINATION PACKAGINGS							SINGLE PACKAGINGS
Packing conditions	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – for solid base material*	*Inner packaging quantity (per receptacle) – for liquid activator*	*Inner packaging quantity (per receptacle) – for solid activator*	*Total quantity per package*	*Total gross mass per package*	
Activator (Organic peroxide)	Plastics*	n/a	30 mL	100 g	1 kg	30 kg	No
	Metal*	n/a	30 mL	100 g			
Base material Division 4.1 Packing Group II	Metal	1.0 kg	n/a	n/a			
	Plastics	1.0 kg	n/a	n/a			
	Glass	1.0 kg	n/a	n/a			
Activator (Organic peroxide)	Plastics*	n/a	30 mL	100 g	5 kg		
	Metal*	n/a	30 mL	100 g			
Base material Division 4.1 Packing Group III	Metal	5.0 kg	n/a	n/a			
	Plastics	5.0 kg	n/a	n/a			
	Glass	2.5 kg	n/a	n/a			

*Including tubes.

The total quantity of kits per package is to be calculated on a one-to-one basis of their volume, that is, 1 L equal to 1 kg.

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

The components may be placed in the same outer packaging provided that they will not interact dangerously in the event of leakage (see 4;1.1.7).

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 451

Passenger and cargo aircraft – wetted explosives (Packing Group I)

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
UN number and proper shipping name		*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 1354 UN 1355 UN 1356 UN 3364 UN 3365 UN 3366 UN 3367 UN 3368 UN 3369 UN 3370	**Trinitrobenzene, wetted** **Trinitrobenzoic acid, wetted** **Trinitrotoluene, wetted** or **TNT, wetted** **Picric acid, wetted** or **Trinitrophenol, wetted**, with not less than 10% water, by mass **Picryl chloride, wetted** or **Trinitrochlorobenzene, wetted** **Trinitrotoluene, wetted** or **TNT, wetted** **Trinitrobenzene, wetted** **Trinitrobenzoic acid, wetted** **Sodium dinitro-o-cresolate, wetted** **Urea nitrate, wetted**	Glass Plastics Metal Plastic bag	0.5 kg	0.5 kg	0.5 kg	No
UN 1336 UN 1337 UN 1357	**Nitroguanidine, wetted** or **Picrite, wetted** **Nitrostarch, wetted** **Urea nitrate, wetted**	Glass Plastics Metal Plastic bag	0.5 kg	15 kg	1 kg	No
UN 1310	**Ammonium picrate, wetted** *See Note 1 below.*	Glass Plastics Metal Plastic bag	0.5 kg	0.5 kg	0.5 kg	No
UN 1349	**Sodium picramate, wetted** *See Note 1 below.*	Glass Plastics Metal Plastic bag	0.5 kg	15 kg	Forbidden	No
UN 1320 UN 1321 UN 1322 UN 1344 UN 1348 UN 1517 UN 3317	**Dinitrophenol, wetted** **Dinitrophenolates, wetted** **Dinitroresorcinol, wetted** **Picric acid, wetted** or **Trinitrophenol, wetted**, with not less than 30% water, by mass **Sodium dinitro-o-cresolate, wetted** **Zirconium picramate, wetted** **2-Amino-4,6-dinitrophenol, wetted** *See Note 1 below.*	Glass Plastics Metal Plastic bag	0.5 kg	15 kg	1 kg	No
UN 1571 UN 2852	**Barium azide, wetted** **Dipicryl sulphide, wetted**	Glass Plastics	0.25 kg	0.5 kg	Forbidden	No
≠ UN 3474	**1-Hydroxybenzotriazole monohydrate**	Glass Plastics	0.5 kg	0.5 kg	0.5 kg	No

Packing Instruction 451

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must be designed and constructed to prevent the loss of water or alcohol content or the content of the phlegmatizer.
— Packagings must be so constructed and closed so as to avoid an explosive over pressure or pressure build-up of more than 300 kPa (3 bar).
— The type of packaging and maximum permitted quantity per packaging are limited by the provisions of SEGMENT 2;1.5.2 and may be less than the limits shown above.
— Plastic or glass inner packagings must be packed in tightly closed metal or rigid plastic receptacles before packing in outer packagings. Inner packagings must be packed with absorbent material in sufficient quantity to absorb the contents in the event of leakage.

For UN 3474

Metal packagings must not be used. Packagings of other material with a small amount of metal, for example metal closures or other metal fittings such as those mentioned in 6;3, are not considered metal packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Other metal (3N2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Plastics (3H1, 3H2)
Other metal (4N)	Plastics (1H1, 1H2)	Steel (3A2)
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 452

Passenger aircraft for UN 2555, 2556 and 2557 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 2555 **Nitrocellulose with water**	Metal	1.0 kg	15 kg	No
	Plastics	1.0 kg		
	Glass	1.0 kg		
	Plastic bag	1.0 kg		
UN 2556 **Nitrocellulose with alcohol**	Metal	1.0 kg	1 kg	No
	Plastics	1.0 kg		
	Glass	1.0 kg		
	Plastic bag	1.0 kg		
UN 2557 **Nitrocellulose, mixture without plasticizer, without pigment** or **Nitrocellulose, mixture without plasticizer, with pigment** or **Nitrocellulose, mixture with plasticizer, without pigment** or **Nitrocellulose, mixture with plasticizer, with pigment**	Metal	1.0 kg	1 kg	No
	Plastics	1.0 kg		
	Glass	1.0 kg		
	Plastic bag	1.0 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must be designed and constructed to prevent the loss of water or alcohol content or the content of the phlegmatizer.
— Packagings must be so constructed and closed so as to avoid an explosive over pressure or pressure build-up of more than 300 kPa (3 bar).

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Other metal (3N2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Plastics (3H1, 3H2)
Other metal (4N)	Plastics (1H1, 1H2)	Steel (3A2)
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
UN number and proper shipping name		*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 2555	**Nitrocellulose with water**	Metal	1.0 kg	50 kg	50 kg
		Plastics	1.0 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
UN 2556	**Nitrocellulose with alcohol**	Metal	1.0 kg	15 kg	15 kg
		Plastics	1.0 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
UN 2557	**Nitrocellulose mixture without plasticizer, without pigment** or **Nitrocellulose mixture without plasticizer, with pigment** or **Nitrocellulose mixture with plasticizer, without pigment** or **Nitrocellulose mixture with plasticizer, with pigment**	Metal	1.0 kg	15 kg	15 kg
		Plastics	1.0 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Other metal (3N2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Plastics (3H1, 3H2)
Other metal (4N)	Plastics (1H1, 1H2)	Steel (3A2)
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 453

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

— Packagings must be designed and constructed to prevent the loss of water or alcohol content or the content of the phlegmatizer.
— Packagings must be so constructed and closed so as to avoid an explosive over pressure or pressure build-up of more than 300 kPa (3 bar).
— Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.

SINGLE PACKAGINGS

Boxes	***Composites***	***Cylinders***	***Drums***	***Jerricans***
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)			Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Plastics (4H2)			Plastics (1H1, 1H2)	
Plywood (4D)			Plywood (1D)	
Reconstituted wood (4F)			Steel (1A1, 1A2)	
Steel (4A)				

COMBINATION PACKAGINGS			
UN number and proper shipping name	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	**SINGLE PACKAGINGS**
UN 1324 **Films, nitrocellulose base**	100 kg	25 kg	No

Packing Instruction 454

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)*	Fibre (1G)*	Plastics (3H1, 3H2)*
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)*	
Plastics (4H1, 4H2)*	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

*These packagings are permitted only for a **maximum of 600 m of film.**

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Total quantity of film per inner packaging*	*Total quantity per package*	*Total gross mass per package*	
UN 1324 **Films, nitrocellulose base**	1 kg	10 kg	30 kg	No

Packing Instruction Y454

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium	Aluminium	Aluminium
Fibreboard*	Fibre*	Plastics*
Natural wood	Other metal	Steel
Other metal	Plastics*	
Plywood	Steel	
Reconstituted wood		
Solid plastic*		
Steel		

*These packagings are permitted only for a **maximum of 600 m or 1 kg** (whichever is more restrictive) of film in one outer packaging.

Packing Instruction 455

Passenger and cargo aircraft for UN 1944 and 1945 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 1944 **Matches, safety** UN 1945 **Matches, wax 'vesta'**	Packaging as set out in the list of outer packagings below may be used. **For a maximum of 50 books** The following packaging is permitted: Strong fibreboard carton, which is made of straw board covered with kraft paper, having a securely glued inside lining consisting of aluminium foil, at least 0.01 mm thick, the carton to have a full depth lid with all joints secured with gummed paper tape.	100 kg	25 kg	No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Matches, safety (book card or strike on box) must be of a type that will not ignite spontaneously under normal conditions of air transport and can be readily ignited by friction only by striking on the manufacturer's box, book or card.
— Matches must be tightly packed to prevent movement within the package and ignition by rubbing against an adjoining box, book or card.
— Matches must be securely wrapped in paper or foil or packed in tightly closed inner packagings.
— No more than 50 books of matches may be packed in one inner packaging.
— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y455

Limited quantities
Passenger and cargo aircraft for UN 1944 and 1945 only

General requirements

SEGMENT4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

   — Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

   — Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

   — SEGMENT3, Section 4 requirements must be met, including:

      — the capability of the package to pass a 1.2 m drop test; and
      — a 24-hour stacking test.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Packing conditions*	*Total mass quantity per package*	*Total gross quantity per package*	
UN 1944 **Matches, safety** UN 1945 **Matches, wax 'vesta'**	Packaging as set out in the list of outer packagings below may be used. **For a maximum of 50 books** The following packaging is permitted: Strong fibreboard carton, which is made of straw board covered with kraft paper, having a securely glued inside lining consisting of aluminium foil, at least 0.01 mm thick, the carton to have a full depth lid with all joints secured with gummed paper tape.	30 kg	10 kg	No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Matches, safety (book card or strike on box) must be of a type that will not ignite spontaneously under normal conditions of air transport and can be readily ignited by friction only by striking on the manufacturer's box, book or card.
— Matches must be tightly packed to prevent movement within the package and ignition by rubbing against an adjoining box, book or card.
— Matches must be securely wrapped in paper or foil or packed in tightly closed inner packagings.
— No more than 50 books of matches may be packed in one inner packaging.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 456

Passenger and cargo aircraft for UN 2000 only

General requirements

SEGMENT4, Section 1 requirements must be met.

UN number and proper shipping name	*Total quantity per package – cargo*	*Total quantity per package – Passenger*
UN 2000 **Celluloid**	100 kg	25 kg

Packing Instruction 457

Passenger and cargo aircraft for UN 3241 only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**	
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – passenger*	*Total quantity per package – cargo*	*Passenger*	*Cargo*
UN 3241 **2-Bromo-2-nitropropane-1,3-diol**	Plastic bag	1.0 kg	25 kg	50 kg	25 kg	50 kg
	Plastics	1.0 kg				
	Glass	0,5 kg				

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
~~Natural wood (4C1, 4C2)~~	~~Plastics (1H1, 1H2)~~	
~~Plastics (4H1, 4H2)~~	~~Plywood (1D)~~	
~~Plywood (4D)~~		
~~Reconstituted wood (4F)~~		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.

Packing Instruction 457

SINGLE PACKAGINGS

Composites	Drums	Jerricans
Plastic receptacle with outer wooden box **(6HC)** Plastic receptacle with outer plywood drum **(6HD1)** Plastic receptacle with outer plywood box **(6HD2)** Plastic receptacle with outer fibre drum **(6HG1)** Plastic receptacle with outer fibreboard box **(6HG2)** Plastic receptacle with outer plastic drum **(6HH1)** Plastic receptacle with outer solid plastic box **(6HH2)**	Plastics (1H1, 1H2)	Plastics (3H1, 3H2)

Packing Instruction Y457

Limited quantities
Passenger and cargo aircraft for UN 3241 only

General requirements

SEGMENT4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT3, Section 4 requirements must be met, including:

— the capability of the package to pass a 1.2 m drop test; and
— a 24-hour stacking test.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
UN 3241 **2-Bromo-2-nitropropane-1, 3-diol**	Plastic Bag	0.5 kg	10 kg	30 kg	No
	Plastics	0.5 kg			
	Glass	0.5 kg			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Fibreboard Natural wood Plastics	Fibre Plastics	Plastics
Plywood Reconstituted wood		

Packing Instruction 458

Passenger and cargo aircraft for UN 3270 only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 3270 **Nitrocellulose membrane filters**	Any packaging from the list of outer packagings below provided that explosion is not possible by reason of increased internal pressure.	15 kg	1 kg	No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Steel (1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y458

Limited quantities
Passenger and cargo aircraft for UN 3270 only

General requirements

SEGMENT4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT3, Section 4 requirements must be met, including:

— the capability of the package to pass a 1.2 m drop test; and
— a 24-hour stacking test.

COMBINATION PACKAGINGS				**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing conditions*	*Total gross mass per package*	*Total quantity per package*	
UN 3270 **Nitrocellulose membrane filters**	Any packaging from the list of outer packagings below provided that explosion is not possible by reason of increased internal pressure.	30 kg	1kg	No

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 459

Passenger and cargo aircraft – self-reactive substances and polymerizing substances

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) Compatibility requirements

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) Closure requirements

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS							SINGLE PACKAGINGS
UN number and proper shipping name		*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – passenger*	*Total quantity per package – passenger*	*Inner packaging quantity (per receptacle) – cargo*	*Total quantity per package – cargo*	
Liquids							
UN 3223	**Self-reactive liquid type C**	Plastics	0.5 L	5 L	1.0 L	10 L	No
UN 3225	**Self-reactive liquid type D**	Plastics	0.5 L	5 L	1.0 L	10 L	
UN 3227	**Self-reactive liquid type E**	Plastics	1.0 L	10 L	2.5 L	25 L	
UN 3229	**Self-reactive liquid type F**	Plastics	1.0 L	10 L	2.5 L	25 L	
UN 3532	**Polymerizing substance, liquid, stabilized, n.o.s.***	Plastics	1.0 L	10 L	2.5 L	25 L	
Solids							
UN 3224	**Self-reactive solid type C**	Plastic bag	0.5 kg	5 kg	1.0 kg	10 kg	No
		Plastics	0.5 kg	5 kg	1.0 kg	10 kg	
UN 3226	**Self-reactive solid type D**	Plastic bag	0.5 kg	5 kg	1.0 kg	10 kg	
		Plastics	0.5 kg	5 kg	1.0 kg	10 kg	
UN 3228	**Self-reactive solid type E**	Plastic bag	1.0 kg	10 kg	2.5 kg	25 kg	
		Plastics	1.0 kg	10 kg	2.5 kg	25 kg	
UN 3230	**Self-reactive solid type F**	Plastic bag	1.0 kg	10 kg	2.5 kg	25 kg	
		Plastics	1.0 kg	10 kg	2.5 kg	25 kg	
UN 3531	**Polymerizing substance, solid, stabilized, n.o.s.***	Plastic bag	1.0 kg	10 kg	2.5 kg	25 kg	
		Plastics	1.0 kg	10 kg	2.5 kg	25 kg	

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Cushioning materials must not be readily combustible.
— Packagings must meet the Packing Group II performance requirements.

UN 3223 or UN3224

Energetic samples classified in accordance with part2, Introductory Section, paragraph 5.4 may be carried under UN 3223 or UN 3224, as appropriate, provided that:

1. The quantity per individual inner cavity does not exceed 0.01 g for solids or 0.01 mL for liquids and the maximum net quantity per outer packaging does not exceed 20 g for solids or 20 mL for liquids, or in the case of mixed packing the sum of grams and millilitres does not exceed 20:

Packing Instruction 459

a) the samples are carried in microtiter plates or multi-titer plates made of plastics, glass, porcelain or stoneware as an inner packaging;

b) only combination packaging with outer packaging comprising boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1 and 4H2) are permitted; or

2. The maximum content of each inner packaging does not exceed 1 g for solids or 1 mL for liquids and the maximum net quantity per outer packaging does not exceed 56 g for solids or 56 mL for liquids, or in the case of mixed packing the sum of grams and millilitres does not exceed 56:

a) The individual substance is contained in an inner packaging of glass or plastics of maximum capacity of 30 mL placed in an expandable polyethylene foam matrix of at least 130 mm thickness having a density of 18 ±1 g/L;

b) Within the foam carrier, inner packagings are segregated from each other by a minimum distance of 40 mm and from the wall of the outer packaging by a minimum distance of 70 mm. The package may contain up to two layers of such foam matrices, each carrying up to twenty-eight inner packagings;

c) The outer packaging consists only of corrugated fibreboard boxes (4G) having minimum dimensions of 60 cm (length) by 40.5 cm (width) by 30 cm (height) and minimum wall thickness of 1.3 cm.

When dry ice or liquid nitrogen is optionally used as a coolant for quality control measures, all applicable requirements of these Technical Standardsmust be met. Interior supports must be provided to secure the inner packagings in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack must be leakproof. If dry ice is used, the requirements in Packing Instruction 954 must be met. The inner and outer packagings must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)		
Reconstituted wood (4F)		

Packing Technical Standards462 – 463

Passenger aircraft

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
462	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
463	III	Metal	5.0 L	5 L	5 L
		Plastics	2.5 L		
		Glass	2.5 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY (PI 463)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Technical Standards464 – 465

Cargo aircraft only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
464	II	Metal	5.0 L	5 L	No
		Plastics	2.5 L		
		Glass	2.5 L		
465	III	Metal	10.0 L	60 L	60 L
		Plastics	5.0 L		
		Glass	5.0 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY (PI 465)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2) Plastics (1H1, 1H2) Steel (1A1, 1A2)	Plastics (3H1, 3H2) Steel (3A1, 3A2)

Packing Technical Standards466 – 469

Passenger aircraft

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
466	II	Metal	1.0 kg	15 kg	No
		Plastics	1.0 kg		
		Glass	1.0 kg		
467	II	Metal	2.5kg	15 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
468	III	Metal	5.0 kg	25 kg	No
		Plastics	2.5 kg		
		Glass	2.5 kg		
469	III	Metal	10.0kg	25 kg	No
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
470	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
471	III	Metal	10.0 kg	100 kg	100 kg
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 470 – 471

SINGLE PACKAGINGS

Boxes	Composites	Cylinders	Drums	Jerricans
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
Natural wood (4C2)			Fibre (1G)	Steel (3A1, 3A2)
Other metal (4N)			Plastics (1H1, 1H2)	
Plastics (4H2)			Plywood (1D)	
Plywood (4D)			Steel (1A1, 1A2)	
Reconstituted wood (4F)				
Steel (4A)				

Packing Instruction 472

Passenger and cargo aircraft for UN 1362 only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 1362 **Carbon, activated**	Plastics	0.1 kg	0.5 kg	No

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Steel (4A)	Steel (1A1, 1A2)	Steel (3A1, 3A2)

Packing Instruction 473

Passenger and cargo aircraft – for UN 1378 and UN 2881 only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) Compatibility requirements
   — Substances must be compatible with their packagings as required by 4;1.1.3.
2) Closure requirements
   — Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS							SINGLE PACKAGINGS	
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – passenger*	*Total quantity per package – passenger*	*Inner packaging quantity (per receptacle) – cargo*	*Total quantity per package – cargo*	*Passenger*	*Cargo*
UN 1378 **Metal catalyst, wetted**	II	Metal	Forbidden		1.0 kg	50 kg	No	No
		Glass			1.0 kg			
UN 2881 **Metal catalyst, dry**	I		Forbidden		Forbidden		No	No
	II	Metal	Forbidden		1.0 kg	50 kg	No	No
		Glass			1.0 kg			
	III	Metal	1.0 kg	25 kg	5.0 kg	100 kg	No	100 kg
		Glass	1.0 kg	25 kg	2.5kg	100 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY

Cylinders	Drums	Jerricans
See 4;2.7	Steel (1A1, 1A2)	Steel (3A1, 3A2)

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y474	II	Metal	0.5 kg	1 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y475	II	Metal	0.5 kg	5 kg		No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y476	III	Metal	1.0 kg	5 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			
Y477	III	Metal	1.0 kg	10 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			

Packing Technical StandardsY474 – Y477

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
478	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
479	III	Metal	5.0 L	5 L	5 L
		Plastics	2.5 L		
		Glass	2.5 L		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 479 only)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Technical Standards480 – 482

Cargo aircraft only

General requirements

Segment4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
480	I	Metal	1.0 L	1 L	No
		Plastics	Forbidden		
		Glass	1.0 L		
481	II	Metal	5.0 L	5 L	No
		Plastics	2.5 L		
		Glass	2.5 L		
482	III	Metal	10.0L	60 L	60 L
		Plastics	5.0 L		
		Glass	5.0 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— Inner packagings must have threaded enclosures and must be surrounded in inert cushioning and absorbent material in a quantity sufficient to absorb the entire contents and enclosed in a leakproof liner, plastic bag or other equally effective means of intermediate leakproof containment.

Packing Group II

— Inner packagings must have threaded enclosures and must be surrounded in inert cushioning and absorbent material in a quantity sufficient to absorb the entire contents.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Technical Standards480 – 482

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUPS I AND II

Cylinders, provided that the general provisions of 4;2.7 are met. Cylinders must be made of steel and subjected to an initial test and period tests every ten years at a pressure of not less than 0.6 Mpa (6 bar) (gauge pressure). During transport, the liquid must be under a layer of inert gas with a gauge pressure of not less than 20 kPa (0.2 bar).

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY (PI 482)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1,1A2)	

Packing Technical Standards483 – 486

Passenger aircraft

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
483	II	Metal	1.0 kg	15 kg	No
		Plastics	1.0 kg		
		Glass	1.0 kg		
484	II	Metal	2.5 kg	15 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
485	III	Metal	5.0 kg	25 kg	No
		Plastics	2.5 kg		
		Glass	2.5 kg		
486	III	Glass	10.0 kg	25 kg	No
		Plastics	10.0 kg		
		Metal	5.0 kg		
		Plastic bag	5.0 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.
- For wetted substances where the outer packaging is not leakproof, a leakproof liner or equally effective means of intermediate containment must be provided.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Technical Standards487 – 491

Cargo aircraft only

General requirements

Segment4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
487	I	Metal	1.0 kg	15 kg	15 kg
		Plastics	1.0 kg		
		Glass	1.0 kg		
488	I	Metal	2.5 kg	15 kg	15 kg
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	2.5 kg		
489	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	2.5 kg		
		Glass	2.5 kg		
490	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
491	III	Metal	10.0 kg	100 kg	100 kg
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— Inner packagings must be hermetically sealed, such as by taping or by threaded closures.

Packing Groups I and II

— For wetted substances where the outer packaging is not leakproof, a leakproof liner or equally effective means of intermediate containment must be provided.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.
— For wetted substances where the outer packaging is not leakproof, a leakproof liner or equally effective means of intermediate containment must be provided.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

— Fibreboard, fibre, wood and plywood single packagings must be fitted with a suitable liner.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP I

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

SINGLE PACKAGINGS FOR PACKING GROUPS II AND III ONLY

Boxes	Composites	Cylinders	Drums	Jerricans
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C2)			Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)			Plastics (1H1, 1H2)	
Plastics (4H2)			Plywood (1D)	
Plywood (4D)			Steel (1A1, 1A2)	
Reconstituted wood (4F)				
Steel (4A)				

Packing Instruction 492

Passenger and cargo aircraft for UN 3292 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Packing conditions*	*Total quantity per package – passenger*	*Total quantity per package – cargo*
≠ UN 3292 **Batteries, containing metallic sodium or sodium alloy**	Batteries may be offered for transport and transported unpacked or in protective enclosures such as fully enclosed or wooden slatted crates that are not subject to the requirements of SEGMENT 6 of these Instructions.	Forbidden	No limit
≠ UN 3292 **Cells, containing metallic sodium or sodium alloy**	There must be sufficient cushioning material to prevent contact between cells and between cells and the internal surfaces of the outer packaging and to ensure that no dangerous movement of the cells within the outer packaging occurs in transport	25 kg	400 kg

ADDITIONAL PACKING REQUIREMENTS

— Packagings for cells must meet the Packing Group II performance requirements.
— Cells and batteries must be protected against short circuit and must be isolated in such a manner as to prevent short circuits.

PACKAGINGS

Boxes

Aluminium (4B)
Fibreboard (4G)
Natural wood (4C1, 4C2)
Other metal (4N)
Plastics (4H1, 4H2)
Plywood (4D)
Reconstituted wood (4F)
Steel (4A)

Drums

Aluminium (1B2)
Fibre (1G)
Other metal (1N2)
Plastics (1H2)
Plywood (1D)
Steel (1A2)

Jerricans

Aluminium (3B2)
Plastics (3H2)
Steel (3A2)

Packing Instruction 493

Passenger aircraft for UN 3399 only

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 3399 **Organometallic substance, liquid, water reactive, flammable**	I	Forbidden			
	II	Glass (see 6;3.2)	1.0 L	1 L	No
		Appropriate cylinders or other pressure vessels (see 4;2.7)	1.0 L	1 L	No
	III	Glass (see 6;3.2)	5.0 L	5 L	No
		Appropriate cylinders or other pressure vessels (see 4;2.7)	5.0 L	5 L	No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Glass containers must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.
— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 494

Cargo aircraft only for UN 3399

General requirements

Segment4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 3399 **Organometallic substance, liquid, water reactive, flammable**	I	Glass (see 6;3.2)	1.0 L	1.0 L	No
		Appropriate cylinders or other pressure vessels (see 4;2.7)	1.0 L	1.0 L	No
	II	Glass (see 6;3.2)	2.5 L	5 L	No
		Appropriate cylinders or other pressure vessels (see 4;2.7)	2.5 L	5 L	No
	III	Glass (see 6;3.2)	5.0 L	60 L	60 L
		Appropriate cylinders or other pressure vessels (see 4;2.7)	5.0 L	60 L	60 L

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

- Inner packagings must have threaded enclosures and must be surrounded in inert cushioning and absorbent material in a quantity sufficient to absorb the entire contents and enclosed in a leakproof liner, plastic bag or other equally effective means of intermediate leakproof containment.

Packing Group II

- Glass inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and enclosed in a leakproof liner, plastic bag or other equally effective means of intermediate leakproof containment.

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

Packing Instruction 494

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY

Appropriate cylinders or pressure vessels as permitted by 4;2.7.

Packing Instruction 495

Passenger and cargo aircraft for UN 3476 only

General requirements

SEGMENT4;1.1.1, 1.1.2 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – passenger*	*Quantity – cargo*
UN 3476 **Fuel cell cartridges**, containing water-reactive substances	5 kg of fuel cell cartridges	50 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.

— The mass of each fuel cell cartridge must not exceed 1 kg.

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium(4B)	Aluminium(1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y495

Limited quantities for UN 3476 only

General requirements

SEGMENT3;4 requirements must be met.

Single packagings are not permitted for limited quantities.

For the purpose of this packing instruction, a fuel cell cartridge is considered an inner packaging.

Fuel cell cartridges containing liquid water reactive fuels are not permitted in limited quantities.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Maximum quantity per package*
UN 3476 **Fuel cell cartridges**, containing water-reactive substances	2.5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Fuel cell cartridges containing solid water reactive fuels must not exceed 0.2 kg solid water reactive fuel per cartridge.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 496

Passenger and cargo aircraft for UN 3476 (contained in equipment) only

General requirements

SEGMENT4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – passenger*	*Quantity – cargo*
UN 3476 **Fuel cell cartridges contained in equipment**, containing water-reactive substances	5 kg of fuel cell cartridges	50 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges that are contained in equipment must be protected against short circuit and the equipment must be protected against inadvertent operation.
— Equipment must be securely cushioned in the outer packagings.
— The mass of each fuel cell cartridge must not exceed 1 kg.
— Fuel cell systems must not charge batteries during transport.
— On passenger aircraft, each fuel cell system and each fuel cell cartridge must conform to IEC 62282-6-100 Ed. 1, including Amendment 1, or a standard approved by the appropriate authority of the State of Origin.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	*Drums*	*Jerricans*
Strong outer packagings		

Packing Instruction 497

Passenger and cargo aircraft for UN 3476 (packed with equipment) only

General requirements

SEGMENT4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – passenger*	*Quantity – cargo*
UN 3476 **Fuel cell cartridges packed with equipment**, containing water-reactive substances	5 kg of fuel cell cartridges	50 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— When fuel cell cartridges are packed with equipment, they must be packed in intermediate packagings together with the equipment they are capable of powering.
— The maximum number of fuel cell cartridges in the intermediate packaging must be the minimum number required to power the equipment, plus two spares.
— The fuel cell cartridges and the equipment must be packed with cushioning material or divider(s) or inner packaging so that the fuel cell cartridges are protected against damage that may be caused by the movement or placement of the equipment and the cartridges within the packaging.
— The mass of each fuel cell cartridge must not exceed 1 kg.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	*Drums*	*Jerricans*
Strong outer packagings		

Packing Instruction 499

Only packagings which are approved by the appropriate national authority for these substances may be used (see 4;2.8). A copy of this approval must accompany each consignment or an annotation that it has been granted must be included with the transport document.

Section 7

CLASS 5 – OXIDIZING SUBSTANCES; ORGANIC PEROXIDES

7.1 GENERAL REQUIREMENTS FOR ORGANIC PEROXIDES

Packagings for organic peroxides must conform to the requirements of 6;1, 6;2, 6;3 and 6;4 and must meet the test requirements of 6;4 for Packing Group II.

Venting of packages is not permitted for air transport.

The packaging of organic peroxides presenting an explosive subsidiary hazard must comply with the provisions of 4;3.2.2 and 4;3.2.3.

7.2 PACKING INSTRUCTIONS

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y540	II	Metal	0.1 L	0.5 L	30 kg	No
		Plastics	0.1 L			
		Glass	0.1 L			
Y541	III	Metal	0.5 L	1.0 L		No
		Plastics	0.5 L			
		Glass	0.5 L			

Packing Technical StandardsY540 – Y541

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y543	II	Metal	0.5 kg	1.0 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
		Paper bag	0.5 kg			
		Fibre	0.5 kg			
Y544	II	Metal	0.5 kg	2.5 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
		Paper bag	0.5 kg			
		Fibre	0.5 kg			

Y545	III	Metal	1.0 kg	5 kg	30 kg	No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			
		Paper bag	1.0 kg			
		Fibre	1.0 kg			
Y546	III	Metal	1.0 kg	10 kg	30 kg	No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			
		Paper bag	1.0 kg			
		Fibre	1.0 kg			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
–	I	Forbidden			
550	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
551	III	Metal	2.5 L	2.5 L	No
		Plastics	2.5 L		
		Glass	2.5 L		

Packing Technical Standards550 – 551

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**
Aluminium (4B)	Aluminium (1B1, 1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Steel (1A1, 1A2)
Plywood (4D)	
Reconstituted wood (4F)	
Steel (4A)	

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
553	I	Metal	1.0 L	2.5 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
554	II	Metal	2.5 L	5 L	No
		Plastics	2.5 L		
		Glass	2.5 L		
555	III	Metal	5.0 L	30 L	30 L
		Plastics	5.0 L		
		Glass	5.0 L		

Packing Technical Standards553 – 555

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— UN 1873, parts of packagings which are in direct contact with perchloric acid must be constructed of glass or plastics.
— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums
Aluminium (4B)	Aluminium (1B1, 1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Steel (1A1, 1A2)
Plywood (4D)	
Reconstituted wood (4F)	
Steel (4A)	

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 555)

Composites	Drums	Jerricans
All (see 6;3.1.18)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
	Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
	Plastics (1H1, 1H2)	Steel (3A1, 3A2)
	Steel (1A1, 1A2)	

Packing Technical Standards557 – 559

Passenger aircraft

General requirements

SEGMENT4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

Packing Technical Standards557 – 559

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
557	I	Metal	1.0 kg	1 kg	No
		Plastics	1.0 kg		
		Glass	1.0 kg		
558	II	Metal	1.0 kg	5 kg	No
		Plastics	1.0 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
559	III	Metal	2.5 kg	25 kg	No
		Plastics	2.5 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
		Paper bag	2.5 kg		
		Fibre	2.5 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Groups I and II

— For wetted substances where the outer packaging is not leakproof, a leakproof liner or equally effective means of intermediate containment must be provided.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.
— For wetted substances where the outer packaging is not leakproof, a leakproof liner or equally effective means of intermediate containment must be provided.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS FOR PACKING GROUP I

Boxes	***Drums***
Aluminium (4B)	Aluminium (1B1, 1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

OUTER PACKAGINGS OF COMBINATION PACKAGINGS FOR PACKING GROUPS II AND III

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
561	I	Metal	1.0 kg	15 kg	15 kg
		Plastics	1.0 kg		
		Glass	1.0 kg		
562	II	Metal	5.0kg	25 kg	25 kg
		Plastics	2.5 kg		
		Glass	2.5kg		
		Plastic bag	2.5 kg		
		Paper bag	2.5 kg		
		Fibre	2.5 kg		
563	III	Metal	5.0 kg	100 kg	100 kg
		Plastics	5.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		
		Paper bag	5.0 kg		
		Fibre	5.0 kg		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS FOR PACKING GROUP I

Boxes	Drums
Aluminium (4B)	Aluminium (1B1, 1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

OUTER PACKAGINGS OF COMBINATION PACKAGINGS FOR PACKING GROUPS II AND III ONLY

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.

Packing Group III

— Packagings must meet the Packing Group II performance requirements.

SINGLE PACKAGINGS FOR PACKING GROUP I

Drums
Aluminium (1B1, 1B2)
Other metal (1N1, 1N2)
Steel (1A1, 1A2)

SINGLE PACKAGINGS FOR PACKING GROUPS II AND III

Boxes	Composites	Cylinders	Drums	Jerricans
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C2)			Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)			Plastics (1H1, 1H2)	
Plastics (4H2)			Plywood (1D)	
Plywood (4D)			Steel (1A1, 1A2)	
Reconstituted wood (4F)				
Steel (4A)				

Packing Instruction 565

Cargo aircraft for UN 3356 only

General requirements

Segment4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 3356 **Oxygen generator, chemical**	The generators must be tightly packed in the outer packagings listed below.	25 kg	Forbidden	Unpackaged No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

a) The generator, without its packaging, must be capable of withstanding a 1.8 m drop test onto a rigid, non-resilient, flat and horizontal surface, in the position most likely to cause actuation, without loss of its contents and without actuation. For portable breathing equipment (PBE), which are in a vacuum-sealed bag as part of their containment system, this test may be conducted on the PBE in the vacuum-sealed bag.

b) When a generator is equipped with an actuating device, it must have at least two positive means of preventing unintentional actuation as follows:

1) mechanically actuated devices:

i) two pins, installed so that each is independently capable of preventing the actuator from striking the primer;
ii) one pin and one retaining ring, each installed so that each is independently capable of preventing the actuator from striking the primer; or
iii) a cover securely installed over the primer and a pin installed so as to prevent the actuator from striking the primer and cover.

2) electrically actuated devices: The electrical leads must be mechanically shorted and the mechanical short must be shielded in metal foil;

3) for PBE:

i) a pin so as to prevent the actuator from striking the primer; and
ii) placed in protective packaging such as a vacuum-sealed bag;

c) The generator(s) must be transported in a package which will meet the following requirements when one generator in the package is actuated:

1) other generators in the package will not be actuated;

2) packaging material will not ignite; and

3) the outside surface temperature of the completed package will not exceed 100°C.

Note.— To enable tests 1), 2) and 3) to be conducted on PBE, it is acceptable to break the vacuum-sealed bag to actuate the generator before placing it in the package.

d) Packagings must meet the Packing Group II performance requirements.

Packing Instruction 565

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Plastics (4H1, 4H2)	Plastics (1H2)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS							SINGLE PACKAGINGS
UN number and proper shipping name		*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – passenger*	*Total quantity per package – passenger*	*Inner packaging quantity (per receptacle) – cargo*	*Total quantity per package – cargo*	
Liquids							
UN 3103	**Organic peroxide type C, liquid**	Plastics	0.5 L	5 L	1.0 L	10 L	No
UN 3105	**Organic peroxide type D, liquid**	Plastics	0.5 L	5 L	1.0 L	10 L	
UN 3107	**Organic peroxide type E, liquid**	Plastics	1.0 L	10 L	2.5 L	25 L	
UN 3109	**Organic peroxide type F, liquid**	Plastics	1.0 L	10 L	2.5 L	25 L	
Solids							
UN 3104	**Organic peroxide type C, solid**	Plastics and plastic bag	0.5 kg	5 kg	1.0 kg	10 kg	No
UN 3106	**Organic peroxide type D, solid**	Plastics and plastic bag	0.5 kg	5 kg	1.0 kg	10 kg	
UN 3108	**Organic peroxide type E, solid**	Plastics and plastic bag	1.0 kg	10 kg	2.5 kg	25 kg	
UN 3110	**Organic peroxide type F, solid**	Plastics and plastic bag	1.0 kg	10 kg	2.5 kg	25 kg	

Packing Instruction 570

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.

Cargo aircraft only

Inner packagings of peroxyacetic acid, stabilized (classified as UN 3107 **Organic peroxide type E, liquid** or UN 3109 **Organic peroxide type F, liquid)** may be fitted with a vent consisting of hydrophobic membrane when the substance is used for purposes such as sterilization, provided:

a) each inner packaging contains not more than 70 mL;

b) the inner packaging is designed so that the vent is not immersed in liquid in any orientation;

c) each inner packaging is enclosed in an intermediate rigid plastic packaging with a small opening to permit release of gas and contains a buffer that neutralizes the contents of the inner packaging in the event of leakage;

d) intermediate packagings are packed in a fibreboard box (4G) outer packaging;

e) each outer packaging contains not more than 1.4 L of liquid; and

f) the rate of oxygen release from the outer packaging does not exceed 15 mL per hour.

Such packages must be transported on cargo aircraft only. The requirements of 4;1.1.6, 4;1.1.12 and 4;7.1.2 do not apply.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)		
Reconstituted wood (4F)		

Section 8

CLASS 6 – TOXIC AND INFECTIOUS SUBSTANCES

8.1 PACKING INSTRUCTIONS

Packing Instruction 603

Passenger and cargo aircraft for UN 3507 only

General requirements

SEGMENT4, Section 1 and SEGMENT4;9.1.2, 9.1.4 and 9.1.7 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and name	*Quantity per package – Cargo*	*Quantity per package – Passenger*
UN 3507 **Uranium hexafluoride, radioactive material, excepted package**, non-fissile or fissile-excepted	Less than 0.1 kg	Less than 0.1 kg

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Substances must be packed in a metal or plastics primary receptacle in a leakproof rigid secondary packaging in a rigid outer packaging.
— Primary inner receptacles must be packed in secondary packagings in a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the secondary packaging. Secondary packagings must be secured in outer packagings with suitable cushioning material to prevent movement. If multiple primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated so as to prevent contact between them.
— The contents must comply with the provisions of 2;7.2.4.5.2.
— The provisions of 6;7.3 must be met.
— In the case of fissile-excepted material, limits specified in 2;7.2.3.5 and 6;7.10.2.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2) Plastics (4H1, 4H2)	Other metal (1N2) Plastics (1H2)	Steel (3A2)
Plywood (4D)	Plywood (1D)	
Reconstituted wood (4F) Steel (4A)	Steel (1A2)	

Packing Instruction 620

This packing instruction applies to UN 2814 and UN 2900.

The following packagings are authorized provided the special packing provisions are met.

Packagings meeting the requirements of 6;6 and approved accordingly consisting of:

a) inner packagings comprising:

1) leakproof primary receptacle(s);

2) a leakproof secondary packaging;

3) other than for solid infectious substances, an absorbent material in sufficient quantity to absorb the entire contents placed between the primary receptacle(s) and the secondary packaging; if multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated so as to prevent contact between them;

b) a rigid outer packaging. The smallest external dimension must be not less than 100 mm.

Additional requirements:

c) Inner packagings containing infectious substances must not be consolidated with inner packagings containing unrelated types of goods. Complete packages may be overpacked in accordance with the provisions of 1;3.1 and 5;2.4.10. Such an overpack may contain dry ice.

d) Other than for exceptional consignments, such as whole organs, which require special packaging, the following additional requirements must apply:

1) Substances consigned at ambient temperatures or at a higher temperature. Primary receptacles must be of glass, metal or plastics. Positive means of ensuring a leakproof seal must be provided, such as a heat seal, a skirted stopper or a metal crimp seal. If screw caps are used, they must be secured by positive means, such as tape, paraffin sealing tape or manufactured locking closure;

2) Substances consigned refrigerated or frozen. Ice, dry ice or other refrigerant must be placed around the secondary packaging(s) or, alternatively, in an overpack with one or more complete packages marked in accordance with 6;6.3. Interior supports must be provided to secure secondary packaging(s) or packages in position after the ice or dry ice has dissipated. If ice is used, the outer packaging or overpack must be leakproof. If dry ice is used, the outer packaging or overpack must permit the release of carbon dioxide gas. The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used;

3) Substances consigned in liquid nitrogen. Plastic primary receptacles capable of withstanding very low temperature must be used. The secondary packaging must also be capable of withstanding very low temperatures and, in most cases, will need to be fitted over the primary receptacle individually. Provisions for the consignment of liquid nitrogen must also be fulfilled. The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the liquid nitrogen;

4) Lyophilized substances may also be transported in primary receptacles that are flame-sealed glass ampoules or rubberstoppered glass vials fitted with metal seals.

e) Whatever the intended temperature of the consignment, the primary receptacle or the secondary packaging must be capable of withstanding, without leakage, an internal pressure producing a pressure differential of not less than 95 kPa. This primary receptacle or secondary packaging must also be capable of withstanding temperatures in the range –40°C to +55°C.

Packing Instruction 620

Note.— The capability of a packaging to withstand an internal pressure without leakage that produces the specified pressure differential should be determined by testing samples of primary receptacles or secondary packagings. Pressure differential is the difference between the pressure exerted on the inside of the receptacle or packaging and the pressure on the outside. The appropriate test method should be selected based on receptacle or packaging type. Acceptable test methods include any method that produces the required pressure differential between the inside and outside of a primary receptacle or a secondary packaging. The test may be conducted using internal hydraulic or pneumatic pressure (gauge) or external vacuum test methods. Internal hydraulic or pneumatic pressure can be applied in most cases as the required pressure differential can be achieved under most circumstances. An external vacuum test is not acceptable if the specified pressure differential is not achieved and maintained. The external vacuum test is a generally acceptable method for rigid receptacles and packagings but is not normally acceptable for:

— *flexible receptacles and flexible packagings;*

— *receptacles and packagings filled and closed under an absolute atmospheric pressure lower than 95 kPa.*

f) Other dangerous goods must not be packed in the same packaging as Division 6.2 infectious substances unless they are necessary for maintaining the viability, stabilizing or preventing degradation or neutralizing the hazards of the infectious substances. A quantity of 30 ml or less of dangerous goods included in Class 3, 8 or 9 may be packed in each primary receptacle containing infectious substances provided these substances meet the requirements of 3;5. These small quantities of dangerous goods of Class 3, 8 or 9 are not subject to any additional requirements of these Technical Standardswhen packed in accordance with this packing instruction.

g) Alternative packagings for the transport of animal material may be authorized by the competent authority in accordance with the provisions of 4;2.8.

Special packing provisions

a) Shippers of infectious substances must ensure that packages are prepared in such a manner that they arrive at their destination in good condition and present no hazard to persons or animals during transport.

b) The definition in 1;3, and the general packing requirements of 4;1, apply to infectious substances packages.

c) An itemized list of contents must be enclosed between the secondary packaging and the outer packaging. When the infectious substances to be transported are unknown, but suspected of meeting the criteria for inclusion in Category A, the words “suspected Category A infectious substance” must be shown in parentheses following the proper shipping name on the itemized list of contents inside the outer packaging.

d) Before an empty packaging is returned to the shipper, or sent elsewhere, it must be disinfected or sterilized to nullify any hazard, and any label or mark indicating that it had contained an infectious substance must be removed or obliterated.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	*Drums*	*Jerricans*
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 621

General requirements

SEGMENT4, Section 1 requirements (except 1.1.20) must be met.

ADDITIONAL PACKING REQUIREMENTS

- The packaging tests may be those appropriate for solids when there is sufficient absorbent material to absorb the entire amount of liquid present and the packaging is capable of retaining liquids. In all other circumstances, the packaging tests must be those appropriate for liquids.
- Packagings intended to contain sharp objects such as broken glass and needles must be resistant to puncture and retain liquids under the performance test conditions for the packaging.
- Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1,1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Technical StandardsY640 – Y642

Limited quantities
Passenger and cargo aircraft

General requirements

SEGMENT4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

   - Substances must be compatible with their packagings as required by 4;1.1.3.
   - Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

   - Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

   - SEGMENT3, Section 4 requirements must be met including:

     - the capability of the package to pass a 1.2 m drop test;
     - a 24-hour stacking test; and
     - inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

Packing Technical StandardsY640 – Y642

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y640	II	Metal	0.1 L	0.5 L	30 kg	No
		Plastics	0.1 L			
		Glass	0.1 L			
Y641	II	Metal	0.1 L	1.0 L		No
		Plastics	0.1 L			
		Glass	0.1 L			
Y642	III	Metal	0.5 L	2.0 L		No
		Plastics	0.5 L			
		Glass	0.5 L			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Technical StandardsY644 – Y645

Limited quantities
Passenger and cargo aircraft

General requirements

SEGMENT4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

- SEGMENT3, Section 4 requirements must be met including:
  - the capability of the package to pass a 1.2 m drop test; and
  - a 24-hour stacking test.

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y644	II	Metal	0.5 kg	1 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
		Paper bag	0.5 kg			
		Fibre	0.5 kg			
Y645	III	Metal	1.0 kg	10 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			
		Paper bag	1.0 kg			
		Fibre	1.0 kg			

Packing Technical StandardsY644 – Y645

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 650

This packing instruction applies to UN 3373.

1) The packaging must be of good quality, strong enough to withstand the shocks and loadings normally encountered during transport, including transhipment between transport units and between transport units and warehouses as well as any removal from a pallet or overpack for subsequent manual or mechanical handling. Packagings must be constructed and closed to prevent any loss of contents that might be caused under normal conditions of transport by vibration or by changes in temperature, humidity or pressure.

2) The packaging must consist of three components:

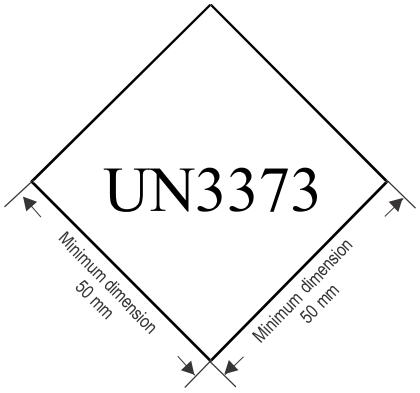
   a) a primary receptacle;

   b) a secondary packaging; and

   c) a rigid outer packaging.

3) Primary receptacles must be packed in secondary packagings in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the secondary packaging. Secondary packagings must be secured in outer packagings with suitable cushioning material. Any leakage of the contents must not compromise the integrity of the cushioning material or of the outer packaging.

4) For transport, the mark illustrated below must be displayed on the external surface of the outer packaging on a background of a contrasting colour and must be clearly visible and legible. The mark must be in the form of a square set at an angle of 45° (diamond-shaped) with each side having a length of at least 50 mm, the width of the line must be at least 2 mm, and the letters and numbers must be at least 6 mm high. The entire mark must appear on one side of the package. The proper shipping name “Biological substance, Category B” in letters at least 6 mm high must be marked on the outer packaging adjacent to the diamond-shaped mark.



5) At least one surface of the outer packaging must have a minimum dimension of 100 mm × 100 mm.

Packing Instruction 650

≠ 6) The completed package must be capable of withstanding a 1.2 m drop in any orientation without leakage from the primary receptacle(s), which must remain protected by absorbent material, when required, in the secondary packaging.

Note. — Capability may be demonstrated by testing, assessment or experience.

7) For liquid substances:

a) The primary receptacle(s) must be leakproof and must not contain more than 1 L;

b) The primary receptacle or the secondary packaging must be capable of withstanding, without leakage, an internal pressure of 95 kPa (0.95 bar); and

c) The secondary packaging must be leakproof;

d) If multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them;

e) Absorbent material must be placed between the primary receptacle(s) and the secondary packaging. The absorbent material must be in quantity sufficient to absorb the entire contents of the primary receptacle(s) so that any release of the liquid substance will not compromise the integrity of the cushioning material or of the outer packaging;

+

Note. — The capability of a packaging to withstand an internal pressure without leakage that produces the specified pressure differential should be determined by testing samples of primary receptacles or secondary packagings. Pressure differential is the difference between the pressure exerted on the inside of the receptacle or packaging and the pressure on the outside. The appropriate test method should be selected based on receptacle or packaging type. Acceptable test methods include any method that produces the required pressure differential between the inside and outside of a primary receptacle or a secondary packaging. The test may be conducted using internal hydraulic or pneumatic pressure (gauge) or external vacuum test methods. Internal hydraulic or pneumatic pressure can be applied in most cases as the required pressure differential can be achieved under most circumstances. An external vacuum test is not acceptable if the specified pressure differential is not achieved and maintained. The external vacuum test is a generally acceptable method for rigid receptacles and packagings but is not normally acceptable for:

— *flexible receptacles and flexible packagings; and*
— *receptacles and packagings filled and closed under an absolute atmospheric pressure lower than 95 kPa.*

> f) The outer packaging must not contain more than 4 L. This quantity excludes ice, dry ice or liquid nitrogen when used to keep specimens cold.

8) For solid substances:

a) The primary receptacle(s) must be siftproof and must not exceed the outer packaging mass limit;

b) If multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact between them;

c) The secondary packaging must be siftproof;

d) Except for packages containing body parts, organs or whole bodies, the outer packaging must not contain more than 4 kg. This quantity excludes ice, dry ice or liquid nitrogen when used to keep specimens cold; and

e) If there is any doubt as to whether or not residual liquid may be present in the primary receptacle during transport, then a packaging suitable for liquids, including absorbent materials, must be used.

9) Refrigerated or frozen specimens: ice, dry ice and liquid nitrogen:

a) When dry ice or liquid nitrogen is used to keep specimens cold, all applicable requirements of these Technical Standardsmust be met. When used, ice or dry ice must be placed outside the secondary packagings or in the outer packaging or an overpack. Interior supports must be provided to secure the secondary packagings in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack must be leakproof. If carbon dioxide, solid (dry ice) is used, the packaging must be designed and constructed to permit the release of carbon dioxide gas to prevent a build-up of pressure that could rupture the packagings; and

b) The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

Packing Instruction 650

10) When packages are placed in an overpack, the package marks required by this packing instruction must either be clearly visible or the marks must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

11) Infectious substances assigned to UN 3373 which are packed and marked in accordance with this packing instruction are not subject to any other requirement in these Technical Standardsexcept for the following:

≠ a) the name and address of the shipper and of the consignee must be provided on each package. The information may be applied through the use of a barcode, QR code or other equivalent means;

b) the name and telephone number of a person responsible must be provided on a written document (such as an air waybill) or on the package;

c) classification must be in accordance with 2;6.3.2;

d) the incident reporting requirements in 7;4.4 and 7;4.5 must be met;

e) the inspection for damage or leakage requirements in 7;3.1.3 and 7;3.1.4; and

f) passengers and crew members are prohibited from transporting infectious substances either as, or in, carry-on baggage or checked baggage or on their person.

Note.— When the shipper or consignee is also the “person responsible” as referred to in b), the name and address need be marked only once in order to satisfy the name and marking provisions in both a) and b).

12) Clear Technical Standardson filling and closing such packages must be provided to the shipper or to the person who prepares the package (such as patient) by packaging manufacturers and subsequent distributors to enable the package to be correctly prepared for transport.

13) Other dangerous goods must not be packed in the same packaging as Division 6.2 infectious substances unless they are necessary for maintaining the viability, stabilizing or preventing degradation or neutralizing the hazards of the infectious substances. A quantity of 30 ml or less of dangerous goods included in Class 3, 8 or 9 permitted as excepted quantities under 3;5 may be packed in each primary receptacle containing infectious substances. When these small quantities of dangerous goods are packed with infectious substances in accordance with this packing instruction no other requirements in these Technical Standardsneed be met.

Additional requirements:

1) Alternative packagings for the transport of animal material may be authorized by the competent authority in accordance with the provisions of 4;2.8.

Packing Technical Standards651 – 655

Passenger aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
651	I	Metal	0.5 L	0.5 L	No
		Plastics	0.5 L		
		Glass	0.5 L		
652	I	Metal	1.0 L	1 L	No
		Plastics	0.5 L		
		Glass	0.5 L		
653	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
654	II	Metal	2.5 L	5 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
655	III	Metal	5.0 L	60 L	60 L
		Plastics	2.5 L		
		Glass	2.5 L		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 655)

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
657	I	Metal	2.5 L	2.5 L	2.5 L
		Plastics	1.0 L		
		Glass	1.0 L		
658	I	Metal	2.5 L	30 L	30 L
		Plastics	1.0 L		
		Glass	1.0 L		
659	II	Metal	2.5 L	5 L	5 L
		Plastics	1.0 L		
		Glass	1.0 L		
660	II	Metal	2.5 L	30 L	30 L
		Plastics	1.0 L		
		Glass	1.0 L		
661	II	Metal	2.5 L	60 L	60 L
		Plastics	1.0 L		
		Glass	1.0 L		
662	II	Metal	5.0 L	60 L	60 L
		Plastics	2.5 L		
		Glass	2.5 L		
663	III	Metal	10.0 L	220 L	220 L
		Plastics	5.0 L		
		Glass	5.0 L		

Packing Technical Standards657 – 663

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group I

— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR PACKING GROUPS I AND II

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1)	Aluminium (3B1)
		Other metal (1N1)	Plastics (3H1)
		Plastics (1H1)	Steel (3A1)
		Steel (1A1)	

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Technical Standards665 – 670

Passenger aircraft

General requirements

Segment 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
665	I	Metal	1.0 kg	1 kg	No
		Plastics	1.0 kg		
		Glass	0.5 kg		
666	I	Metal	1.0 kg	5 kg	No
		Plastics	1.0 kg		
		Glass	0.5 kg		
667	II	Metal	2.5 kg	5 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
668	II	Metal	2.5 kg	15 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
669	II	Metal	2.5 kg	25 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
670	III	Metal	10.0 kg	100 kg	100 kg
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		
		Paper bag	5.0 kg		
		Fibre	5.0 kg		

Packing Technical Standards665 – 670

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 670)

Bags	Boxes	Composites	Cylinders	Drums	Jerricans
Paper (5M2) Plastic film (5H4) Textile (5L3) Woven plastics (5H3)	Aluminium (4B) Fibreboard (4G) Natural wood (4C2) Other metal (4N) Plastics (4H2) Plywood (4D) Reconstituted wood (4F) Steel (4A)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2) Fibre (1G) Other metal (1N1, 1N2) Plastics (1H1, 1H2) Plywood (1D) Steel (1A1, 1A2)	Aluminium (3B1, 3B2) Plastics (3H1, 3H2) Steel (3A1, 3A2)

Packing Technical Standards672 – 677

Cargo aircraft only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion for substances with a Class 8 subsidiary hazard.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

Packing Technical Standards672 – 677

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
672	I	Metal	2.5 kg	15 kg	15 kg
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
673	I	Metal	2.5 kg	50 kg	50 kg
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
		Paper bag	1.0 kg		
		Fibre	1.0 kg		
674	II	Metal	5.0 kg	25 kg	25 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
		Paper bag	2.5 kg		
		Fibre	2.5 kg		
675	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
		Paper bag	2.5 kg		
		Fibre	2.5 kg		
676	II	Glass	5.0 kg	100 kg	100 kg
		Plastics	5.0 kg		
		Metal	2.5 kg		
		Plastic bag	2.5 kg		
		Paper bag	2.5 kg		
		Fibre	2.5 kg		
677	III	Metal	10.0 kg	200 kg	200 kg
		Plastics	10.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		
		Paper bag	5.0 kg		
		Fibre	5.0 kg		

Packing Technical Standards672 – 677

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.

SINGLE PACKAGINGS FOR PACKING GROUP I

Composites	**Cylinders**	**Drums**	**Jerricans**
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Fibre (1G)	Plastics (3H1, 3H2)
		Other metal (1N1, 1N2)	Steel (3A1, 3A2)
		Plastics (1H1, 1H2)	
		Plywood (1D)	
		Steel (1A1, 1A2)	

SINGLE PACKAGINGS FOR PACKING GROUPS II AND III ONLY

Boxes	***Composites***	***Cylinders***	***Drums***	***Jerricans***
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G))	Plastics (3H1, 3H2)
Natural wood (4C2)			Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)			Plastics (1H1, 1H2)	
Plastics (4H2)			Plywood (1D)	
Plywood (4D)			Steel (1A1, 1A2)	
Reconstituted wood (4F				
Steel (4A)				

SINGLE PACKAGINGS FOR PACKING GROUP III (PI 677 only)

Bags	*Boxes*	*Composites*	*Cylinders*	*Drums*	*Jerricans*
Paper (5M2) Plastic film (5H4) Textile (5L3) Woven plastics (5H3)	Aluminium (4B) Fibreboard (4G) Natural wood (4C2) Other metal (4N) Plastics (4H2) Plywood (4D) Reconstituted wood (4F) Steel (4A)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2) Fibre (1G) Other metal (1N1, 1N2) Plastics (1H1, 1H2) Plywood (1D) Steel (1A1, 1A2)	Aluminium (3B1, 3B2) Plastics (3H1, 3H2) Steel (3A1, 3A2)

Packing Instruction 679

Cargo aircraft only for UN 1700, 2016 and 2017 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				Maximum net quantity per package
UN number and proper shipping name		*Packing conditions*	*Single Packaging*	
UN 1700	**Tear gas candles**	Elements must not be assembled in grenades or devices, but must be packed in a separate wooden (4C1, 4C2) box and so cushioned that they cannot come into contact with each other or with the walls of the packaging during transport. Not more than 24 grenades and 24 functioning devices per package are permitted.	NO	50 kg
UN 2016	**Ammunition, toxic, non-explosive**	Without ignition elements, bursting charges, detonating fuses or other explosive components.	NO	75 kg
UN 2017	**Ammunition, tear-producing, non-explosive**	Without ignition elements, bursting charges, detonating fuses or other explosive components.	NO	50 kg

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group II performance requirements.
— The articles must be individually packaged and separated from each other using partitions, dividers, inner packagings or cushioning material to prevent inadvertent discharge during normal conditions of transport.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***
Aluminium (4B)	Aluminium (1B1, 1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

Packing Instruction 680

Passenger and cargo aircraft for UN 1888 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**	
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle) – Cargo*	*Inner packaging quantity (per receptacle) – Passenger*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	*Cargo*	*Pass*
UN 1888 **Chloroform**	Glass	2.5 L	1.0 L	220 L	60 L	220 L	NO
	Plastics	2.5 L	1.0 L				
	Metal	5.0 L	2.5 L				

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY

Composites	***Cylinders***	***Drums***	***Jerricans***
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Instruction Y680

Limited quantities
Passenger and cargo aircraft for UN 1888 only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met including:

— the capability of the package to pass a 1.2 m drop test;
— a 24-hour stacking test; and
— inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
UN 1888 **Chloroform**	III	Metal	0.1 L	2 L	30 kg	No
		Plastics	0.1 L			
		Glass	0.1 L			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Inner packagings must be packed with sufficient absorbent material to absorb the entire contents of the inner packagings and placed in a rigid leakproof receptacle before packing in outer packagings.

Packing Instruction 681

Cargo aircraft only for Chlorosilanes

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number	*Inner packaging (see 6;3.2)*	*Net quantity per inner packaging*	*Total quantity per package*	
UN 3361, UN 3362	Steel	5.0 L	30.0 L	30.0 L
	Plastics	Forbidden		
	Glass	1.0 L		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS

Boxes	Drums
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

SINGLE PACKAGINGS

Composites	Cylinders	Drums	Jerricans
Plastic receptacle in steel drum (6HA1)	Steel (as permitted by 4;2.7)	Steel (1A1)	Steel (3A1)

Packing Instruction 699

Passenger and cargo aircraft for UN 3123 and UN 3125 only

Only packagings which are approved by the appropriate national authority for these substances may be used (see 4;2.8). A copy of this approval must accompany each consignment or an annotation that it has been granted must be included with the transport document.

Section 9

CLASS 7 – RADIOACTIVE MATERIAL

9.1 GENERAL

9.1.1 Radioactive material, packagings and packages must meet the requirements of 6;7. The quantity of radioactive material in a package must not exceed the limits specified in 2;7.2.4. The types of packages for radioactive materials covered by these Technical Standardsare:

a) Excepted package (see 1;6.1.5);

b) Industrial package Type 1 (Type IP-1 package);

c) Industrial package Type 2 (Type IP-2 package);

d) Industrial package Type 3 (Type IP-3 package);

e) Type A package;

f) Type B(U) package;

g) Type B(M) package;

h) Type C package.

Packages containing fissile material or uranium hexafluoride are subject to additional requirements.

9.1.2 The non-fixed contamination on the external surfaces of any package must be kept as low as practicable and, under routine conditions of transport, must not exceed the following limits:

a) 4 Bq/cm^2 for beta and gamma emitters and low toxicity alpha emitters; and

b) 0.4 Bq/cm^2 for all other alpha emitters.

These limits are applicable when averaged over any area of 300 cm^2 of any Segment of the surface.

9.1.3 A package must not contain any other items except such articles and documents as are necessary for the use of the radioactive material. This requirement must not preclude the transport of low specific activity material or surface contaminated objects with other items. The transport of such articles and documents in a package, or of low specific activity material or surface contaminated objects with other items may be permitted provided that there is no interaction between them and the packaging or its radioactive contents that would reduce the safety of the package.

9.1.4 Except as provided in 7;3.2.5, the level of non-fixed contamination on the external and internal surfaces of overpacks and freight containers, must not exceed the limits specified in 9.1.2. This requirement does not apply to the internal surfaces of freight containers being used as packagings, either loaded or empty.

9.1.5 Radioactive material meeting the criteria of other Classes or Divisions as defined in SEGMENT 2 must be allocated to Packing Group I, II or III, as appropriate, by the application of the grouping criteria provided in SEGMENT 2 corresponding to the nature of the predominant subsidiary hazard. It must also be capable of meeting the appropriate packaging performance criteria for the subsidiary hazard.

9.1.6 Before a packaging is first used to transport radioactive material, it must be confirmed that it has been manufactured in conformity with the design specifications to ensure compliance with the relevant provisions of these Technical Standardsand any applicable certificate of approval. The following requirements must also be fulfilled, if applicable:

a) If the design pressure of the containment system exceeds 35 kPa (gauge), it must be ensured that the containment system of each packaging conforms to the approved design requirements relating to the capability of that system to maintain its integrity under that pressure;

b) For each packaging intended for use as a **Type B(U), Type B(M)** and **Type C** package and for each packaging intended to contain fissile material, it must be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design;

c) For each packaging intended to contain fissile material, it must be ensured that the effectiveness of the criticality safety features is within the limits applicable to or specified for the design and in particular where, in order to comply with the requirements of 6;7.10.1 neutron poisons are specifically included, checks must be performed to confirm the presence and distribution of those neutron poisons.

9.1.7 Before each shipment of any package, it must be ensured that the package does not contain:

a) radionuclides different from those specified for the package design; or

b) contents in a form, or physical or chemical state different from those specified for the package design.

9.1.8 Before each shipment of any package, it must be ensured that all the requirements specified in the relevant provisions of these Technical Standardsand in the applicable certificates of approval have been fulfilled. The following requirements must also be fulfilled, if applicable:

a) It must be ensured that lifting attachments which do not meet the requirements of 6;7.1.2 have been removed or otherwise rendered incapable of being used for lifting the package, in accordance with 6;7.1.3;

b) Each **Type B(U), Type B(M)** and **Type C** package must be held until equilibrium conditions have been approached closely enough to demonstrate compliance with the requirements for temperature and pressure unless an exemption from these requirements has received unilateral approval;

c) For each **Type B(U)**, **Type B(M)** and **Type C package**, it must be ensured by inspection and/or appropriate tests that all closures, valves, and other openings of the containment system through which the radioactive contents might escape are properly closed and, where appropriate, sealed in the manner for which the demonstrations of compliance with the requirements of 6;7.7.8 and 6;7.9.3 were made;

d) For packages containing fissile material, the measurement specified in 6;7.10.5 b) and the tests to demonstrate closure of each package as specified in 6;7.10.8 must be performed;

e) For packages intended to be used for shipment after storage, it must be ensured that all packaging components and radioactive contents have been maintained during storage in a manner such that all the requirements specified in the relevant provisions of these Technical Standardsand in the applicable certificates of approval have been fulfilled.

9.1.9 The shipper must also have a copy of any Technical Standardswith regard to the proper closing of the package and any preparation for shipment before making any shipment under the terms of the certificates.

9.1.10 Except for consignments under exclusive use, the transport index of any package or overpack must not exceed 10, nor must the criticality safety index of any package or overpack exceed 50.

≠ 9.1.11 Except for packages or overpacks transported under exclusive use and special arrangement under the conditions specified in 7;2.9.5.3, the maximum dose rate at any point on any external surface of a package or overpack must not exceed 2 mSv/h.

9.1.12 The maximum dose rate at any point on any external surface of a package or overpack under exclusive use must not exceed 10 mSv/h.

9.2 REQUIREMENTS AND CONTROLS FOR TRANSPORT OF LSA MATERIAL AND SCO

9.2.1 The quantity of LSA material or SCO in a single Industrial package Type 1 (Type IP-1), Industrial package Type 2 (Type IP-2), or Industrial package Type 3 (Type IP-3), must be so restricted that the external dose rate at 3 m from unshielded material does not exceed 10 mSv/h.

9.2.2 LSA material and SCO which are or contain fissile material, which is not excepted under 2;7.2.3.5, must meet the applicable requirements in 7;2.9.4.1 and 7;2.9.4.2.

9.2.3 LSA material and SCO which are or contain fissile material must meet the applicable requirements of 6;7.10.1.

9.2.4 LSA-I material, SCO-I and fissile material must not be transported unpackaged.

9.2.5 LSA material and SCO must be packaged in accordance with Table 4-2.

9.3 PACKAGES CONTAINING FISSILE MATERIAL

The contents of packages containing fissile material must be as specified for the package design either directly in these Technical Standardsor in the certificate of approval.

Table 4-2. Industrial package requirements for LSA material and SCO

	Industrial package type	
Radioactive contents	*Not under exclusive use*	*Exclusive use*
LSA-I Solid Liquid	Type IP-1 Type IP-2	Type IP-1 Type IP-1
LSA-II Solid Liquid and gas	Type IP-2 Type IP-3	Type IP-2 Type IP-2
LSA-III	Type IP-3	Type IP-2
SCO-I	Type IP-1	Type IP-1
SCO-II	Type IP-2	Type IP-2

Segment 4 Section 10

CLASS 8 – CORROSIVE SUBSTANCES

10.1 PACKING INSTRUCTIONS

COMBINATION PACKAGINGS						SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y840	II	Metal	0.1L	0.5 L	30 kg	No
		Plastics	0.1L			
		Glass	0.1L			
Y841	III	Metal	0.5 L	1.0 L		No
		Plastics	0.5 L			
		Glass	0.5 L			

Packing Technical StandardsY840 – Y841

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS						**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	*Total gross mass per package*	
Y843	II	Metal	0.5 kg	1 kg	30 kg	No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y844	II	Metal	0.5 kg	5 kg		No
		Plastics	0.5 kg			
		Glass	0.5 kg			
		Plastic bag	0.5 kg			
Y845	III	Metal	1.0 kg	5 kg		No
		Plastics	1.0 kg			
		Glass	1.0 kg			
		Plastic bag	1.0 kg			

Packing Technical StandardsY843 – Y845

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
850	I	Metal	0.5 L	0.5 L	No
		Plastics	0.5 L		
		Glass	0.5 L		
851	II	Metal	1.0 L	1 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
852	III	Metal	5.0 L	5 L	No
		Plastics	2.5 L		
		Glass	2.5 L		

Packing Technical Standards850 – 852

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
854	I	Metal	1.0 L	2.5 L	No
		Plastics	1.0 L		
		Glass	1.0 L		
855	II	Metal	2.5 L	30 L	30 L
		Plastics	2.5 L		
		Glass	2.5 L		
856	III	Metal	10.0 L	60 L	60 L
		Plastics	5.0 L		
		Glass	5.0 L		

Packing Technical Standards854 – 856

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

SINGLE PACKAGINGS FOR PACKING GROUP II

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1)	Aluminium (3B1)
		Other metal (1N1)	Plastics (3H1)
		Plastics (1H1)	Steel (3A1)
		Steel (1A1)	

SINGLE PACKAGINGS FOR PACKING GROUP III ONLY

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Technical Standards858 – 860

Passenger aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

- Substances must be compatible with their packagings as required by 4;1.1.3.
- Metal packagings must be corrosion resistant or be protected against corrosion.
- Substances of Class 8 are permitted in glass or earthenware inner packagings only if the substance is free from hydrofluoric acid.

2) **Closure requirements**

- Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
858	I	Metal	0.5 kg	1 kg	No
		Plastics	0.5 kg		
		Glass	0.5 kg		
859	II	Metal	2.5 kg	15 kg	No
		Plastics	2.5 kg		
		Glass	1.0 kg		
		Plastic bag	1.0 kg		
860	III	Metal	5.0 kg	25 kg	No
		Plastics	2.5 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Packing Group III

- Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

COMBINATION PACKAGINGS					SINGLE PACKAGINGS
Packing instruction	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
862	I	Metal	2.5 kg	25 kg	25 kg
		Plastics	2.5 kg		
		Glass	1.0 kg		
863	II	Metal	5.0 kg	50 kg	50 kg
		Plastics	5.0 kg		
		Glass	2.5 kg		
		Plastic bag	2.5 kg		
864	III	Metal	10.0 kg	100 kg	100 kg
		Plastics	5.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Technical Standards862 – 864

SINGLE PACKAGINGS FOR PACKING GROUP I

Composites	Cylinders	Drums	Jerricans
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Fibre (1G)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Plywood (1D)	
		Steel (1A1, 1A2)	

SINGLE PACKAGINGS FOR PACKING GROUPS II AND III ONLY

Boxes	Composites	Cylinders	Drums	Jerricans
Aluminium (4B)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)			Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C2)			Plastics (1H1, 1H2)	Steel (3A1, 3A2)
Other metal (4N)			Plywood (1D)	
Plastics (4H2)			Steel (1A1, 1A2)	
Plywood (4D)				
Reconstituted wood (4F)				
Steel (4A)				

COMBINATION PACKAGINGS				SINGLE PACKAGINGS
UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 2028 **Bombs, smoke, non-explosive** with corrosive liquid, without initiating device	Bombs, smoke may be carried provided they are without ignition elements, bursting charges, detonating fuses or other explosive components.	50 kg	Forbidden	No

Packing Instruction 866

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**
Aluminium (4B)	Aluminium (1B2)
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N2)
Other metal (4N)	Plastics (1H2)
Plastics (4H1, 4H2)	Steel (1A2)
Plywood (4D)	
Reconstituted wood (4F)	
Steel (4A)	

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 2803 **Gallium**	Plastics	3.5 kg	20 kg	20 kg	No

Boxes	**Drums**
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Steel (1A1, 1A2)
Plywood (4D)	
Reconstituted wood (4F)	
Steel (4A)	

Packing Instruction 867

CARRIAGE AT LOW TEMPERATURES

When it is necessary to transport Gallium at low temperatures in order to maintain it in a completely solid state, packagings may be overpacked in strong water-resistant outer packagings which contain dry ice or other means of refrigeration. If a refrigerant is used, all of the above materials used in the packaging of gallium must be chemically and physically resistant at the low temperatures of the refrigerant employed. If dry ice is used, the outer packaging must permit the release of carbon dioxide gas.

Packing Instruction 868

Passenger and cargo aircraft for UN 2809 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	
UN 2809 **Mercury**	Plastic	2.5 kg	35 kg	35 kg	See below
	Glass	2.5 kg			

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group I performance requirements.
— Inner packagings must be enclosed in liners or bags of strong leakproof and puncture resistant material impervious to the contents and completely surrounding the contents to prevent it from escaping from a package irrespective of its position or orientation.
— Inner packagings must be packed with sufficient cushioning material to prevent breakage.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)
Other metal (4N)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Steel (1A1, 1A2)
Plywood (4D)	
Reconstituted wood (4F)	
Steel (4A)	

SINGLE PACKAGINGS

Mercury may also be packed in a single packaging which may only be a welded steel bottle with an inner vaulted bottom, an opening not exceeding 20 mm and a closure which must be a bolt with a conical thread.

Packing Instruction 869

Passenger and cargo aircraft for UN Nos. 3506 and 3554 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS			
UN number and proper shipping name	*Net quantity* per package – passenger*	*Net quantity* per package – cargo*	**SINGLE PACKAGINGS**
UN 3506 **Mercury contained in manufactured articles** UN 3554 **Gallium contained in manufactured articles**	No limit	No limit	No

*For the purposes of SEGMENT 5;4.1.5.1 the "net quantity" shown on the dangerous goods transport document is the net mass of the manufactured articles in each package.

ADDITIONAL PACKING REQUIREMENTS

— Manufactured articles or apparatuses of which metallic mercury or gallium is a component SEGMENT, such as manometers, pumps, thermometers and switches must be packed in sealed inner liners or bags of strong leakproof and puncture-resistant material impervious to mercury or gallium, as appropriate, which will prevent the escape of mercury or gallium from the package irrespective of its position before being packed in outer packagings.

Note. — Mercury switches and relays are excepted from the requirement for a sealed inner liner or bag providing they are of the totally enclosed leakproof type in sealed metal or plastic units.

— Electron tubes, mercury vapour tubes (tubes with less than a total net quantity of 450 g of mercury) must be packed in strong outer packagings with all seams and joints sealed with self-adhesive, pressure-sensitive tape which will prevent the escape of mercury from the package.

Note. — Tubes with 450 g of mercury or more must be packaged according to the requirements for manufactured articles or apparatuses (above).

— Electron tubes which are packed in sealed leakproof metal cases may be shipped in the manufacturer's original packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	*Drums*	*Jerricans*
Strong outer packagings		

Packing Instruction 870

Passenger and cargo aircraft for UN 2794 and 2795 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*
UN 2794 **Batteries, wet, filled with acid** UN 2795 **Batteries, wet, filled with alkali**	Batteries must be placed in an acid/alkali-proof liner of sufficient strength and adequately sealed to positively preclude leakage in the event of spillage. The batteries must be packed so that the fill openings and vents, if any, are upward; they must be incapable of short-circuiting and be securely cushioned in the packagings. The upright position of the package must be indicated on it by "Package orientation" labels (Figure 5-29) as required by 5;3. The words "This side up" or "This end up" may also be displayed on the top of the package.	400 kg	30 kg

ADDITIONAL PACKING REQUIREMENTS

— Packagings must meet the Packing Group II performance requirements.
— For batteries, electric storage, packed with battery fluid in the same outer packaging, see UN 2796 and UN 2797.

PACKAGINGS

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Plastics (4H1, 4H2)	Plastics (1H2)	
Plywood (4D)	Plywood (1D)	
Reconstituted wood (4F)	Steel (1A2)	
Steel (4A)		

Packing Instruction 871

Passenger and cargo aircraft for UN 3028 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*
UN 3028 **Batteries, dry, containing potassium hydroxide solid**	The batteries must be securely cushioned in the packagings.	230 kg	25 kg

ADDITIONAL PACKING REQUIREMENTS

— Packagings must meet the Packing Group II performance requirements.

PACKAGINGS

Boxes
Aluminium (4B))
Fibreboard (4G)
Natural wood (4C1, 4C2)
Plastics (4H2)
Plywood (4D)
Reconstituted wood (4F)
Steel (4A)

Packing Instruction 872

Passenger and cargo aircraft for UN 2800

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Packing conditions*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*
UN 2800 **Batteries, wet, non-spillable**	Batteries must be protected against short circuits and must be securely packed in strong outer packagings.	No limit	No limit

PACKAGINGS

Boxes	**Drums**	**Jerricans**
Strong outer packagings		

Packing Instruction 873

Passenger and cargo aircraft for UN 3477

General requirements

SEGMENT 4;1.1.1, 1.1.2 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3477 **Fuel cell cartridges**	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— The mass of each fuel cell cartridge must not exceed 1 kg.
— Packagings must meet the Packing Group II performance requirements.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium(4B)	Aluminium(1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction Y873

Limited quantities for UN 3477 only

General requirements

SEGMENT 3;4 requirements must be met.

Single packagings are not permitted for limited quantities.

For the purpose of this packing instruction, a fuel cell cartridge is considered an inner packaging.

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Maximum quantity per package*
UN 3477 **Fuel cell cartridges**, containing corrosive substances	2.5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges must be securely cushioned in the outer packagings.
— Fuel cell cartridges must not exceed 0.2 L of liquid corrosive fuel or 0.2 kg of solid corrosive fuel per cartridge.

Packing Instruction Y873

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 874

Passenger and cargo aircraft for UN 3477 (contained in equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3477 **Fuel cell cartridges contained in equipment**, containing corrosive substances	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— Fuel cell cartridges that are contained in equipment must be protected against short circuits and the equipment must be protected against inadvertent operation.
— Equipment must be securely cushioned in the outer packagings.
— The mass of each fuel cell cartridge must not exceed 1 kg.
— Fuel cell systems must not charge batteries during transport.
— On passenger aircraft, each fuel cell system and each fuel cell cartridge must conform to IEC 62282-6-100 Ed. 1, including Amendment 1, or a standard approved by the appropriate authority of the State of Origin.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Strong outer packagings		

Packing Instruction 875

Passenger and cargo aircraft for UN 3477 (packed with equipment) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3477 **Fuel cell cartridges packed with equipment**, containing corrosive substances	50 kg of fuel cell cartridges	5 kg of fuel cell cartridges

ADDITIONAL PACKING REQUIREMENTS

— When fuel cell cartridges are packed with equipment, they must be packed in intermediate packagings together with the equipment they are capable of powering.
— The maximum number of fuel cell cartridges in the intermediate packaging must be the minimum number required to power the equipment, plus 2 spares.
— The fuel cell cartridges and the equipment must be packed with cushioning material or divider(s) or inner packaging so that the fuel cell cartridges are protected against damage that may be caused by the movement or placement of the equipment and the cartridges within the packaging.
— The mass of each fuel cell cartridge must not exceed 1 kg.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Strong outer packagings		

Packing Instruction 876

Cargo aircraft only for Chlorosilanes

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.
— Metal packagings must be corrosion resistant or be protected against corrosion.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS				SINGLE PACKAGINGS	
UN number	*Inner packaging (see 6;3.2)*	*Net quantity per inner packaging – cargo*	*Total quantity per package – cargo*	*Passenger*	*Cargo*
UN 1724, UN 1728, UN 1747, UN 1753, UN 1762, UN 1763, UN 1766, UN 1767, UN 1769, UN 1771, UN 1781, UN 1784, UN 1799, UN 1800, UN 1801, UN 1804, UN 1816, UN 1818, UN 2434, UN 2435, UN 2437, UN 2986, UN 2987	Steel	5.0 L	30.0 L	No	30.0 L
	Plastics	Forbidden			
	Glass	1.0 L			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS

Boxes	**Drums**
Fibreboard (4G)	Fibre (1G)
Natural wood (4C1, 4C2)	Plastics (1H1, 1H2)
Plastics (4H1, 4H2)	Plywood (1D)
Plywood (4D)	Steel (1A1, 1A2)
Reconstituted wood (4F)	
Steel (4A)	

SINGLE PACKAGINGS FOR CARGO AIRCRAFT ONLY

Composites	**Cylinders**	**Drums**	**Jerricans**
Plastic receptacle in steel drum (6HA1)	Steel (as permitted by 4;2.7)	Steel (1A1)	Steel (3A1)

Segment 4 Section 11

CLASS 9 – MISCELLANEOUS DANGEROUS GOODS

11.1 PACKING INSTRUCTIONS

Packing Instruction 950

Passenger and cargo aircraft for UN 3166 only
(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 951 for flammable gas-powered vehicles, Packing Instruction 952 for battery-powered equipment and vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

Compatibility requirements

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3166 **Vehicle, flammable liquid powered** or **Vehicle, fuel cell, flammable liquid powered**	No limit	No limit

ADDITIONAL PACKING REQUIREMENTS

Flammable liquid fuel tanks

Except as otherwise provided for in this packing instruction, fuel tanks must be drained of fuel and tank caps fitted securely. Special precautions are necessary to ensure complete drainage of the fuel system of vehicles incorporating internal combustion engines, such as lawn mowers, where such vehicles could possibly be handled in other than an upright position. When it is not possible to handle in other than an upright position, vehicles, except those with diesel engines, must be drained of fuel as far as practicable, and if any fuel remains, it must not exceed one-quarter of the tank capacity.

Diesel engines

Vehicles equipped with diesel engines are excepted from the requirement to drain the fuel tanks, provided that sufficient ullage space has been left inside the tank to allow fuel expansion without leakage, and the tank caps are tightly closed. A careful check must be made to ensure there are no fuel leakages.

Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In addition:

≠ 1) If spillable batteries are installed, and it is possible for the vehicle to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries are installed:

i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

ii) lithium batteries must meet the provisions of SEGMENT 2;9.3, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

≠ 3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Packing Instruction 950

Other operational equipment

1) Dangerous goods required for the operation or safety of the vehicle, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the vehicle. Aircraft may also contain other articles and substances which would otherwise be classified as dangerous goods but which are installed in that aircraft in accordance with the pertinent airworthiness requirements and operating regulations. If fitted, life-rafts, emergency escape slides and other inflation devices must be protected such that they cannot be activated accidentally. Vehicles containing dangerous goods identified in Table 3-1 as forbidden on passenger aircraft may only be transported on cargo aircraft. Replacements for the dangerous goods permitted must not be carried under this packing instruction.

2) Vehicles equipped with theft-protection devices, installed radio communications equipment or navigational systems must have such devices, equipment or systems disabled.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3166 **Vehicle, flammable gas powered** or **Vehicle, fuel cell, flammable gas powered**	Forbidden	No limit

Packing Instruction 951

Flammable liquid fuel tanks

If a vehicle is powered by a flammable liquid and a flammable gas internal combustion engine, the requirements set out in Packing Instruction 950 for flammable liquid fuel tanks must also be met.

Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle and must be protected in such a manner so as to prevent damage and short circuits. In addition:

≠ 1) If spillable batteries are installed, and it is possible for the vehicle to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries are installed:

   i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

   ii) lithium batteries must meet the provisions of SEGMENT 2;9.3, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Other operational equipment

1) Dangerous goods required for the operation or safety of the vehicle, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the vehicle, machine or equipment. Aircraft may also contain other articles and substances which would otherwise be classified as dangerous goods but which are installed in that aircraft in accordance with the pertinent airworthiness requirements and operating regulations. If fitted, life-rafts, emergency escape slides and other inflation devices must be protected such that they cannot be activated accidentally. Vehicles containing dangerous goods identified in Table 3-1 as forbidden on passenger aircraft may only be transported on cargo aircraft. Replacements for the dangerous goods permitted must not be carried under this packing instruction.

2) Vehicles equipped with theft-protection devices, installed radio communications equipment or navigational systems must have such devices, equipment or systems disabled.

Packing Instruction 952

≠ Passenger and cargo aircraft for UN Nos. 3171, 3556, 3557 and 3558 only
(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles or Packing Instruction 972 for engines or machinery containing only environmentally hazardous fuels)

General requirements

Segment 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3171 **Battery-powered equipment** or **Battery-powered vehicle** UN 3556 **Vehicle, lithium-ion battery powered** UN 3557 **Vehicle, lithium metal battery powered** UN 3558 **Vehicle, sodium ion battery powered**	No limit	No limit

ADDITIONAL PACKING REQUIREMENTS

This entry applies to vehicles and equipment, including machinery, which are powered by wet batteries, metallic sodium or sodium alloy batteries and to vehicles powered by lithium batteries or sodium ion batteries and which are transported with these batteries installed. Examples of such vehicles and equipment are electrically-powered cars, lawn mowers, wheelchairs and other mobility aids. Vehicles that also contain an internal combustion engine must be consigned under the entry UN 3166 Vehicle (flammable gas powered) (See Packing Instruction 951) or Vehicle (flammable liquid powered) (See Packing Instruction 950), as appropriate.

Where vehicles or equipment could possibly be handled in other than an upright position, the vehicle or equipment must be secured in a strong, rigid outer packaging of the type below. The vehicle or equipment must be secured and restrained in the outer packaging to prevent any movement during transport which could change the orientation or cause the vehicle or equipment to be damaged.

Vehicles and equipment must be equipped with an effective means of preventing accidental activation.

Battery-powered vehicles or equipment must meet the following requirements:

Batteries

All batteries must be installed and securely fastened in the battery holder of the vehicle or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

1) If spillable batteries are installed, and it is possible for the vehicle or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries or sodium ion batteries are installed:

   i) batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport;

   ii) lithium batteries must meet the provisions of Segment 2;9.3 and sodium ion batteries must meet the provisions of Segment 2;9.4, except that pre-production prototypes of lithium batteries or sodium ion batteries, when these prototypes are transported for testing, or low production runs of lithium batteries or sodium ion batteries that have not been tested to the requirements in Segment III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment;

iii) where the battery is removed from the vehicle and is packed separate from the vehicle in the same outer packaging, the package must be consigned as UN 3481 – **Lithium ion batteries packed with equipment**, UN 3552 – **Sodium ion batteries packed with equipment** or UN 3091 – **Lithium metal batteries packed with equipment** and packed according to Packing Instruction 966, 969 or 977, as applicable; and

iv) for UN 3556 – **Vehicle, lithium ion battery powered**, UN 3557 – **Vehicle, lithium metal battery powered** when the battery is rechargeable, and UN 3558 – **Vehicle, sodium ion battery powered**:

1) **Until 31 December 2025**

Vehicles should be offered for transport with:

— the battery(ies) at a state of charge not exceeding 30 per cent of their rated capacity; or
— an indicated battery capacity not exceeding 25 per cent.

2) **From 1 January 2026**

a) Vehicles powered by batteries with a Watt-hour rating more than 100 Wh must be offered for transport with:

— the battery(ies) at a state of charge not exceeding 30 per cent of their rated capacity; or
— an indicated battery capacity not exceeding 25 per cent.

b) Vehicles powered by batteries with a Watt-hour rating not more than 100 Wh should be offered for transport with:

— the battery(ies) at a state of charge not exceeding 30 per cent of their rated capacity; or
— an indicated battery capacity not exceeding 25 per cent.

c) Vehicles powered by batteries with a Watt-hour rating in excess of 100 Wh and at a state of charge exceeding 30 per cent of their rated capacity or with an indicated battery capacity exceeding 25 per cent may only be offered for transport with the approval of the appropriate national authorities of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note. — Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Other operational equipment

1) Dangerous goods required for the operation or safety of the vehicle or equipment, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the vehicle or equipment. Aircraft may also contain other articles and substances which would otherwise be classified as dangerous goods but which are installed in that aircraft in accordance with the pertinent airworthiness requirements and operating regulations. If fitted, life-rafts, emergency escape slides and other inflation devices must be protected such that they cannot be activated accidentally. Vehicles or equipment containing dangerous goods identified in Table 3-1 as forbidden on passenger aircraft may only be transported on cargo aircraft. Replacements for the dangerous goods permitted must not be carried under this packing instruction.

2) Vehicles equipped with theft-protection devices, installed radio communications equipment or navigational systems must have such devices, equipment or systems disabled.

Strong outer packagings — vehicles and equipment

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 953

Passenger and cargo aircraft for UN 2807 only

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 2807 **Magnetized material**	No limit	No limit

Magnetized materials with field strengths causing a compass deflection of more than 2 degrees at a distance of 2.1 m but not more than 2 degrees at a distance of 4.6 m (equivalent to 0.418 A/m or 0.00525 Gauss measured at a distance of 4.6 m) are not subject to any other requirements in these Technical Standardswhen carried as cargo except for the following:

a) the shipper must make prior arrangements with the operator identifying the magnetized material. The dangerous goods transport document requirements of SEGMENT 5;4 are not applicable provided alternative written or electronic documentation includes the words “magnetized material” in association with the description of the goods;

b) the package must bear the magnetized material handling label;

c) the operator must stow the packaged magnetized material in accordance with 7;2.10; and

d) the incident reporting requirements of 7;4.4 must be met.

Magnetized material with a field strength sufficient to cause a compass deflection of more than 2 degrees at a distance of 4.6 m may only be transported with the prior approval of the appropriate authority of the State of Origin and the State of the Operator.

Packing Instruction 954

Passenger and cargo aircraft for UN 1845 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 1845 **Carbon dioxide, solid** or **Dry ice**	200 kg	200 kg

ADDITIONAL PACKING REQUIREMENTS

In packages:

a) must be packed in accordance with the general packing requirements of 4;1 and be in packaging designed and constructed to permit the release of carbon dioxide gas to prevent a build-up of pressure that could rupture the packaging;

b) the shipper must make arrangements with the operator(s) for each shipment, to ensure that ventilation safety procedures are followed;

c) the dangerous goods transport document requirements of 5;4 are not applicable provided alternative written documentation is provided describing the contents. The information on the document must be shown in the location provided for the description of the goods. Where an agreement exists with the operator, the shipper may provide the information by electronic data processing (EDP) or electronic data interchange (EDI) techniques. The information required is as follows and should be shown in the following order:

1) UN 1845;

2) **Carbon dioxide, solid** or **Dry ice**;

3) the number of packages and the net quantity of dry ice in each package; and

d) the net mass of the **Carbon dioxide, solid** or **Dry ice** must be marked on the outside of the package.

Dry ice may be shipped in a unit load device prepared by a single shipper provided that:

a) the shipper has made prior arrangements with the operator;

b) the unit load device does not contain dangerous goods other than UN 3373, **Biological substance, Category B** or ID 8000, **Consumer commodity**. Where the unit load device contains UN 3373 or ID 8000, the provisions of these Technical Standardsthat apply to those substances must be met in addition to the provisions set out in this packing instruction;

c) the unit load device must allow the venting of the carbon dioxide gas to prevent a dangerous build-up of pressure (the marking requirements of 5;2 and the labelling requirements of 5;3 do not apply to the unit load device); and

d) the shipper must provide the operator with written documentation or, where agreed with the operator, information by EDP or EDI techniques, stating the total quantity of the dry ice contained in the unit load device.

Packing Instruction 955

Passenger and cargo aircraft for UN 2990 and UN 3072 only

The term “life-saving appliances” applies to articles such as life rafts, life vests, aircraft survival kits or aircraft evacuation slides.

The description “Life-saving appliances, self-inflating” (UN 2990) is intended to apply to life-saving appliances that present a hazard if the self-inflating device is activated accidentally.

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

   — Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

   — Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 2990 **Life-saving appliances, self-inflating** UN 3072 **Life-saving appliances, not self-inflating** containing dangerous goods as equipment	No limit	No limit

ADDITIONAL PACKING REQUIREMENTS

Life-saving appliances may only contain the dangerous goods listed below:

a) Division 2.2 gases must be contained in cylinders which conform to the requirements of the appropriate national authority of the country in which they are approved and filled. Such cylinders may be connected to the life-saving appliance. These cylinders may include installed actuating cartridges (cartridges, power device of Division 1.4C and 1.4S) provided the aggregate quantity of deflagrating (propellant) explosives does not exceed 3.2 grams per unit. When the cylinders are shipped separately, they must be classified as appropriate for the Division 2.2 gas contained and need not be marked, labelled or described as explosive articles;

b) signal devices (Class 1), which may include smoke and illumination signal flares; signal devices must be packed in plastic or fibreboard inner packagings;

c) small quantities of flammable substances, corrosive solids and organic peroxides (Class 3, Class 8, Division 4.1 and 5.2), which may include a repair kit and not more than 30 strike-anywhere matches. The organic peroxide may only be a component of a repair kit and the kit must be packed in strong inner packaging. The strike-anywhere matches must be packed in a cylindrical metal or composition packaging with a screw-type closure and be cushioned to prevent movement;

d) electric storage batteries (Class 8), which must be disconnected or electrically isolated and protected against short circuits;

≠ e) lithium batteries and sodium ion batteries:

   1) identified as damaged or defective in accordance with Special Provision A154 are forbidden for transport;

   2) must meet the applicable requirements of 2;9.3 or 2;9.4, as applicable;

   3) must be disconnected or electrically isolated and protected against short circuits; and

   4) must be secured against movement within the appliance.

f) first aid kits which may include flammable, corrosive and toxic articles or substances.

The appliances must be packed, so that they cannot be accidentally activated, in strong outer packagings and, except for life vests, the dangerous goods must be in inner packagings packed so as to prevent movement. The dangerous goods must be an integral SEGMENT of the appliance without which it would not be operational and in quantities which do not exceed those appropriate for the actual appliance when in use.

Life-saving appliances may also include articles and substances not subject to these Technical Standardswhich are an integral SEGMENT of the appliance.

Packing Instruction 956

Passenger and cargo aircraft for UN 1841, UN 1931, UN 2216, UN 3432, UN 2969, UN 3077, UN 3152 and UN 3335 only

General requirements

Segment 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS	
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – Cargo*	*Total quantity per package – Passenger*	Quantity – passenger	Quantity – cargo
UN 1841 **Acetaldehyde ammonia**	Metal	50.0 kg	200 kg	200 kg	200 kg	200 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				
UN 1931 **Zinc dithionite** or **Zinc hydrosulphite**	Metal	50.0 kg	100 kg	200 kg	100 kg	200 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				
UN 2216 **Fish meal, stabilized**	Metal	50.0 kg	100 kg	200 kg	100 kg	200 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper	50.0 kg				
	Plastics	50.0 kg				
UN 2969 **Castor beans** or **Castor flake** or **Castor meal** or **Castor pomace**	Metal	50.0 kg	No limit	No limit	No Limit	No Limit
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				
UN 3077 **Environmentally hazardous substance, solid, n.o.s.**	Metal	50.0 kg	400 kg	400 kg	400 kg	400 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				
UN 3152 **Polyhalogenated biphenyls, solid** or **Polyhalogenated terphenyls, solid** or **Halogenated monomethyl-diphenylmethanes, solid**	Metal	50.0 kg	100 kg	200 kg	100 kg	200 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				
UN 3335 **Aviation regulated solid, n.o.s.**	Metal	50.0 kg	400 kg	400 kg	400 kg	400 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				

Packing Instruction 956

COMBINATION PACKAGINGS					SINGLE PACKAGINGS	
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – passenger*	*Total quantity per package – cargo*	Quantity – passenger	Quantity – cargo
UN 3432 **Polychlorinated biphenyls, solid**	Metal	50.0 kg	100 kg	200 kg	100 kg	200 kg
	Fibre	50.0 kg				
	Glass	10.0 kg				
	Plastic bag	50.0 kg				
	Paper bag	50.0 kg				
	Plastics	50.0 kg				

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

— Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.

SINGLE PACKAGINGS

Bags	Boxes	Composites	Cylinders	Drums	Jerricans
Paper (5M2) Plastic film (5H4) Textile (5L3) Woven plastics (5H3)	Aluminium (4B) Fibreboard (4G) Natural wood (4C2) Other metal (4N) Plastics (4H2) Plywood (4D) Reconstituted wood (4F) Steel (4A)	All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2) Fibre (1G) Other metal (1N1, 1N2) Plastics (1H1, 1H2) Plywood (1D) Steel (1A1, 1A2)	Aluminium (3B1, 3B2) Plastics (3H1, 3H2) Steel (3A1, 3A2)

Packing Instruction 956

INTERMEDIATE BULK CONTAINERS FOR UN 3077 ONLY

For UN 3077, irrespective of the maximum net quantities specified in the columns 11 and 13 of the Dangerous Goods List (Table 3-1) and as provided above for single packagings, intermediate bulk containers (IBCs) with a maximum net quantity not exceeding 1 000 kg are permitted as shown below. Each IBC must be in accordance with Section 6.5 of the United Nations Model Regulations and must bear the required UN mark.

Metal	**Rigid plastic**	**Composite with plastic inner receptacle**	**Fibreboard**	**Wooden**	**Flexible**
Steel (11A), (21A) Aluminium (11B), (21B) Other than steel or aluminium (11N), (21N)	For solids, filled or discharged by gravity, fitted with structural equipment (11H1) For solids, filled or discharged by gravity, free-standing (11H2) For solids, filled or discharged under pressure, fitted with structural equipment (21H1) For solids, filled or discharged under pressure, free-standing (21H2)	For solids, filled or discharged by gravity, with rigid plastic inner receptacle (11HZ1) For solids, filled or discharged by gravity, with flexible plastic inner receptacle (11HZ2) For solids, filled or discharged under pressure, with rigid plastic inner receptacle (21HZ1) For solids, filled or discharged under pressure, with flexible plastic inner receptacle (21HZ2)	For solids, filled or discharged by gravity (11G)	Natural wood for solids, filled or discharged by gravity with inner liner (11C) Plywood for solids, filled or discharged by gravity, with inner liner (11D) Reconstituted wood for solids, filled or discharged by gravity, with inner liner (11F)	Woven plastic, coated (13H2) Woven plastic with liner (13H3) Woven plastic, coated and with liner (13H4) Plastic film (13H5) Textile coated (13L2) Textile with liner (13L3) Textile coated and with liner (13L4) Paper multi-wall (13M1) Paper multi-wall, water-resistant (13M2)
		(The IBC Code must be completed by replacing the letter Z with a capital letter indicating the nature of the material used for the outer casing (A for steel; B for aluminium; C for natural wood; D for plywood; F for reconstituted wood; G for fibreboard; H for plastic material; L for textile; M for paper, multi-walled; and N for metal other than steel or aluminium.))			

ADDITIONAL PACKING REQUIREMENTS FOR INTERMEDIATE BULK CONTAINERS

— Flexible IBCs must be sift-proof and water-resistant or must be fitted with a sift-proof and water-resistant liner.

Packing Instruction Y956

Limited quantities
Passenger and cargo aircraft for UN 3077 and UN 3335 only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met, including:

— the capability of the package to pass a 1.2 m drop test; and
— a 24-hour stacking test.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total gross mass per package*	
UN 3077 **Environmentally hazardous substance, solid, n.o.s.** UN 3335 **Aviation regulated solid, n.o.s.***	III	Metal	5.0 kg	30 kg	No
		Plastics	5.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		
		Paper bag	5.0 kg		
		Fibre	5.0 kg		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 957

Passenger and cargo aircraft for UN 2211 and UN 3314 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Quantity – passenger*	*Quantity – cargo*	**SINGLE PACKAGINGS**
UN 2211 **Polymeric beads, expandable**, evolving flammable vapour UN 3314 **Plastics moulding compound** in dough, sheet or extruded rope form evolving flammable vapour	Metal	50 kg	100 kg	200 kg	Yes
	Fibre	50 kg			
	Glass	10 kg			
	Plastic bag	50 kg			
	Plastics	50 kg			
	Paper bag	50 kg			

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

For other than metal and plastics packagings, a sealed plastic liner must be used.

SINGLE PACKAGINGS

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural Wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 958

Passenger and cargo aircraft for UN 2071 and UN 2590 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name		*Inner packaging (see 6.3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package*	
UN 2071 UN 2590	**Ammonium nitrate based fertilizers** **Asbestos, chrysotile**	Metal	50 kg	200 kg	200 kg
		Fibre	50 kg		
		Glass	10 kg		
		Plastic bag	50 kg		
		Plastics	50 kg		
		Paper bag	50 kg		

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

Plastic, paper and fibre inner packagings must be siftproof.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics(4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A1, 1A2)	
Reconstituted wood (4F)		
Steel (4A)		

ADDITIONAL PACKING REQUIREMENTS FOR SINGLE PACKAGINGS

— Fibre, fibreboard, wood and plywood single packagings must be fitted with a suitable liner.
— For UN 2590, bags must be placed in closed rigid overpacks.

SINGLE PACKAGINGS

Bags	**Boxes**	**Drums**	**Jerricans**
Paper (5M2)	Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Plastics (5H4)	Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Textile(5L3)	Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Woven plastics (5H3)	Other metal (4N)	Plastics (1H1, 1H2)	
	Plastics (4H2)	Plywood (1D)	
	Plywood (4D)	Steel (1A2)	
	Reconstituted wood (4F)		
	Steel (4A)		

Packing Instruction Y958

Limited quantities
Passenger and cargo aircraft

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met, including:

— the capability of the package to pass a 1.2 m drop test; and
— a 24-hour stacking test.

COMBINATION PACKAGINGS					**SINGLE PACKAGINGS**
UN number and proper shipping name	*Packing group*	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total gross mass per package*	
UN 2071 **Ammonium nitrate based fertilizer**	III	Metal	5.0 kg	30 kg	No
		Plastics	5.0 kg		
		Glass	5.0 kg		
		Plastic bag	5.0 kg		
		Paper bag	5.0 kg		
		Fibre	5.0 kg		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

Packing Instruction 959

Passenger and cargo aircraft for UN 3245 only

General requirements

SEGMENT 4, Sections 1 and 2 requirements must be met, including:

1) **Compatibility requirements**

   — Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

   — Closures must meet the requirements of 4;1.1.4.

The following packagings are authorized:

1) Packagings meeting the provisions of 4;1.1.1, 4;1.1.3.1, 4;1.1.5 and 4;2 and so designed that they meet the construction requirements of 6;3. Outer packagings constructed of suitable material of adequate strength and designed in relation to the packaging capacity and its intended use must be used. Where this packing instruction is used for the transport of inner packagings of combination packagings, the packaging must be designed and constructed to prevent inadvertent discharge during normal conditions of transport.

2) Packagings, which need not conform to the packaging test requirements of SEGMENT 6, but conforming to the following:

   a) an inner packaging comprising:

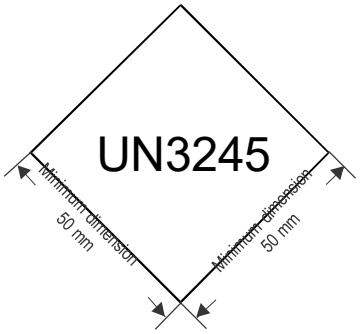
      1) primary receptacle(s) and a secondary packaging, the primary receptacle(s) or the secondary packaging must be leakproof for liquids or siftproof for solids;

      2) for liquids, absorbent material placed between the primary receptacle(s) and the secondary packaging. The absorbent material must be in a quantity sufficient to absorb the entire contents of the primary receptacle(s) so that any release of the liquid substance will not compromise the integrity of the cushioning material or of the outer packaging;

      3) if multiple fragile primary receptacles are placed in a single secondary packaging they must be individually wrapped or separated to prevent contact between them;

   b) an outer packaging must be strong enough for its capacity, mass and intended use, and with a smallest external dimension of at least 100 mm.

For transport, the mark illustrated below must be displayed on the external surface of the outer packaging on a background of a contrasting colour and must be clearly visible and legible. The mark must be in the form of a square set at an angle of 45° (diamond-shaped) with each side having a length of at least 50 mm; the width of the line must be at least 2 mm and the letters and numbers must be at least 6 mm high. The entire mark must appear on one side of the package.



When packages are placed in an overpack, the package marks required by this packing instruction must either clearly be visible or the marks must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

Packing Instruction 959

GMOs or GMMOs assigned to UN 3245 which are packed and marked in accordance with this packing instruction are not subject to any other requirement in these Technical Standardsexcept for the following:

1) the name and address of the shipper and of the consignee must be provided on each package;
2) classification must be in accordance with 2;9.2 c);
3) the incident reporting requirements in 7;4.4 and 7;4.5 must be met;
4) the inspection for damage or leakage requirements in 7;3.1.3 and 7;3.1.4;
5) passengers and crew members are prohibited from transporting UN 3245 either as, or in, carry-on baggage or checked baggage or on their person.

ADDITIONAL PACKING REQUIREMENTS

— When dry ice or liquid nitrogen is used, all applicable requirements of these Technical Standardsmust be met. When used, ice or dry ice must be placed outside the secondary packagings or in the outer packaging or an overpack. Interior supports must be provided to secure the secondary packagings in the original position after the ice or dry ice has dissipated. If ice is used, the outside packaging or overpack must be leakproof. If dry ice is used, the requirements in Packing Instruction 954 must be met.
— The primary receptacle and the secondary packaging must maintain their integrity at the temperature of the refrigerant used as well as the temperatures and the pressures which could result if refrigeration were lost.

Packing Instruction 960

Passenger and cargo aircraft for UN 3316 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*State*	*Inner packaging* (see 6;3.2)*	*Maximum quantity of dangerous goods per kit***	*Package quantity – Cargo*	*Package quantity Passenger*	**SINGLE PACKAGING S**
UN 3316 **Chemical kit** or **First aid kit**	Solid	250 g	1 L	10 kg	10 kg	No
	Liquid	250 ml	1 kg			

* Containing dangerous goods.
** The total quantity of dangerous goods in any one kit must not exceed 1 L or 1 kg.

ADDITIONAL PACKING REQUIREMENTS

— Kits may contain dangerous goods which require segregation according to Table 7-1.
— Packagings must meet the performance standards of the most stringent packing group assigned to any individual substance contained in the kit. Where the kit contains only dangerous goods to which no packing group is assigned, packagings must meet Packing Group II performance standards.
— Kits must not be packed with other dangerous goods in the same outer packaging, with the exception of dry ice. If dry ice is used, the requirements in Packing Instruction 954 must be met.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes
Aluminium (4B)
Fibreboard (4G)
Natural wood (4C1, 4C2)
Other metal (4N)
Plastics (4H1, 4H2)
Plywood (4D)
Reconstituted wood (4F)
Steel (4A)

Packing Instruction Y960

Limited quantities
Passenger and cargo aircraft for UN 3316 only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18 and 1.1.20 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met except 3;4.3.3, including:

— the capability of the package to pass a 1.2 m drop test; and
— a 24-hour stacking test.

UN number and proper shipping name	*State*	*Inner packaging* (see 6;3.2)*	*Maximum quantity of dangerous goods per kit*	*Maximum quantity of dangerous goods per package*	*Total gross mass per package*	**SINGLE PACKAGINGS**
UN 3316 **Chemical kit** or **First aid kit**	Solid	100 g	1 kg	1 kg	30 kg	No
	Liquid	30 mL				
*Containing dangerous goods.						

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Kits may contain dangerous goods which require segregation according to Table 7-1. The packing group assigned to the kit as a whole must be the most stringent packing group assigned to any individual substance contained in the kit.
— Kits must not be packed with other dangerous goods in the same outer packaging, with the exception of dry ice. If dry ice is used, the requirements in Packing Instruction 954 must be met.
— The total quantity of dangerous goods in any one kit and in any one package must not exceed 1 kg.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes
Aluminium Fibreboard
Natural wood
Other metal
Plastics
Plywood
Reconstituted wood Steel

Packing Instruction 961

≠ Passenger and cargo aircraft for UN Nos. 3268 and 3559 only

General requirements

SEGMENT 4, Section 1 requirements must be met, including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

UN number and proper shipping name	*Quantity – passenger*	*Quantity – cargo*	**SINGLE PACKAGINGS**
UN 3268 **Safety devices**, electrically initiated + UN 3559 **Fire suppressant dispersing devices**	25 kg	100 kg	No

ADDITIONAL PACKING REQUIREMENTS FOR COMBINATION PACKAGINGS

— Packagings must meet the Packing Group III performance requirements.
— The packagings must be designed and constructed to prevent movement of the articles and inadvertent operation during normal conditions of transport.
— Any pressure receptacle must be in accordance with the requirements of the appropriate national authority for the substance(s) contained therein.

Cargo aircraft only

Air bag inflators, air bag modules and seat-belt pretensioners may also be transported unpackaged on cargo aircraft in dedicated handling devices when transported to, from, or between where they are manufactured and an assembly plant including intermediate handling locations. When transported in handling devices, the following conditions must be met:

a) air bag inflators, air bag modules or seat-belt pretensioners as fitted in the handling device must be capable of meeting the test criteria prescribed in Special Provision A115;

b) the handling device must be completely enclosed;

c) each air bag inflator, air bag module or seat-belt pretensioner unit must be secured within the handling device to prevent movement in transport; and

d) irrespective of the limit specified in column 13 of Table 3-1, a handling device meeting these requirements may have a gross mass not exceeding 1 000 kg.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	*Drums*	*Jerricans*
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 962

Passenger and cargo aircraft for UN 3363 only

General requirements

SEGMENT 4, Section 1 requirements must be met (except that the requirements of 4;1.1.2, 1.1.9, 1.1.13 and 1.1.16 do not apply), including:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

This entry only applies to articles, such as machinery, apparatus or devices containing dangerous goods as a residue or as an integral element of the article. It must not be used for an article for which a proper shipping name exists in Table 3-1. For other than fuel system components, articles may only contain one or more of the following: dangerous goods permitted under 3;4.1.2 or UN 2807 or gases of Division 2.2 without subsidiary hazard but excluding refrigerated liquefied gases.

UN number and proper shipping name		*State*	*Total net quantity of dangerous goods in one package (excluding magnetic material)*
UN 3363	**Dangerous goods in apparatus** or **Dangerous goods in machinery** or **Dangerous goods in articles**	Solid	I kg
		Liquid	0.5 L
		Gas (Division 2.2 only)	0.5 kg

ADDITIONAL PACKING REQUIREMENTS

— If the article contains more than one item of dangerous goods, the individual dangerous goods must be enclosed to prevent them reacting dangerously with one another during transport (see 4;1.1.3).
— Receptacles containing dangerous goods must be so secured or cushioned so as to prevent their breakage or leakage and so as to control their movement within the article during normal conditions of transport. Cushioning material must not react dangerously with the contents of the receptacles. Any leakage of the contents must not substantially impair the protective properties of the cushioning material.
— "Package orientation" labels (Figure 5-29), or preprinted orientation labels meeting the same specification as either Figure 5-29 or ISO Standard 780-1997 must be affixed on at least two opposite vertical sides with the arrows pointing in the correct direction only when required to ensure liquid dangerous goods remain in their intended orientation.
— Irrespective of 5;3.2.10, articles containing magnetized material meeting the requirements of Packing Instruction 953 must also bear the "Magnetized material" label (Figure 5-27).
— For Division 2.2 gases, cylinders for gases, their contents and filling ratios must conform to the requirements of Packing Instruction 200.
— Dangerous goods in articles must be packed in strong outer packagings unless the receptacles containing the dangerous goods are afforded adequate protection by the construction of the articles.

Fuel system components

— Fuel system components must be emptied of fuel as far as practicable and all openings must be sealed securely. They must be packed:

1) in sufficient absorbent material to absorb the maximum amount of liquid which may possibly remain after emptying. Where the outer packaging is not liquid tight, a means of containing the liquid in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally efficient means of containment; and

2) in strong outer packagings.

Packing Instruction Y963

Limited quantities
Passenger and cargo aircraft for ID 8000 only

Consumer commodities are materials that are packaged and distributed in a form intended or suitable for retail sale for the purposes of personal care or household use. These include items administered or sold to patients by doctors or medical administrations. Except as otherwise provided below, dangerous goods packed in accordance with this packing instruction do not need to comply with 4;1 or Segment 6 of these Technical Standards; they must, however, comply with all other applicable requirements. Other dangerous goods not classified as ID 8000 must not be packed in the same outer packaging with ID 8000.

a) Each packaging must be designed and constructed to prevent leakage that may be caused by changes in altitude and temperature during air transport.

b) Inner packagings that are breakable (such as earthenware, glass or brittle plastic) must be packed to prevent breakage and leakage under conditions normally incident to transport. Each package offered for transport must be capable of withstanding a 1.2 m drop on solid concrete in the position most likely to cause damage. The criteria for passing the test is that the outer packaging must not exhibit any damage liable to affect safety during transport and there must be no leakage from the inner packaging(s). Each package offered for transport must be capable of withstanding, without breakage or leakage of any inner packaging and without significant reduction of effectiveness, a force applied to the top surface for a duration of 24 hours equivalent to the total weight of identical packages if stacked to a height of 3 m (including the test sample).

c) When filling receptacles for liquids, sufficient ullage (outage) must be left to ensure that neither leakage nor permanent distortion of the receptacle will occur as a result of an expansion of the liquid caused by temperatures likely to prevail during transport. Unless specific requirements are prescribed in national rules or international agreements, liquids must not completely fill a receptacle at a temperature of 55°C. At this temperature a minimum ullage of 2 per cent should be left. The primary packaging (which may include composite packaging), for which retention of the liquid is a basic function, must be capable of withstanding, without leakage, an internal pressure which produces a pressure differential of not less than 75 kPa or a pressure related to the vapour pressure of the liquid to be conveyed, whichever is the greater. The pressure related to the vapour pressure must be determined by the method shown in 4;1.1.6. Tests on sample receptacles must be carried out to demonstrate the capability of the primary packaging to withstand the above pressure.

d) Stoppers, corks or other such friction-type closures must be held securely, tightly and effectively in place by positive means. The closure device must be so designed that it is extremely improbable that it can be incorrectly or incompletely closed and must be such that it may be easily checked to determine that it is completely closed.

e) Inner packagings must be tightly packed in strong outer packagings and must be so packed, secured or cushioned so as to prevent any breakage, puncture or leakage of contents into the outer packaging(s) during normal conditions of transport. Absorbent material must be provided for glass or earthenware inner packaging(s) containing consumer commodities in Class 3 or liquids of Division 6.1, in sufficient quantity to absorb the liquid contents of the largest of such inner packagings contained in the outer packaging. Absorbent and cushioning material must not react dangerously with the contents of the inner packagings. Notwithstanding the above, absorbent material may not be required if the inner packagings are so protected that breakage of the inner packagings and leakage of their contents from the outer packaging will not occur during normal conditions of transport.

f) Inner packagings containing liquids must be packed with their closures upward and the upright position of the package must be indicated by “Package orientation” labels (Figure 5-29). These labels, or pre-printed package orientation labels meeting the same specification as either Figure 5-29 or ISO Standard 780-1997, must be affixed to, or printed on, at least two opposite vertical sides of the package with the arrows pointing in the correct direction. The requirements of this sub-paragraph do not apply to:

   1) dangerous goods in inner packagings each containing not more than 120 mL with sufficient absorbent material between the inner and outer packagings to completely absorb the liquid contents; or

   2) dangerous goods in gas tight inner packagings such as tubes, bags or vials which are opened by breaking or puncturing.

g) Each completed package as prepared for shipment must not exceed a gross mass of 30 kg G.

Packing Instruction Y963

h) Class 2 substances must be further limited to aerosol products containing non-toxic compressed or liquefied gas(es). Aerosols must meet the requirements of SEGMENT 6;5.4. The valves must be protected by a cap or other suitable means during transport.

i) Except for aerosols, inner packagings must not exceed:

   1) 500 mL for liquids; and

   2) 500 g for solids.

j) Consumer commodities shipped according to these provisions may be shipped in a unit load device prepared by a single shipper provided they contain no other dangerous goods other than UN 1845 – **Carbon dioxide, solid** (dry ice) used as a refrigerant. When the unit load device contains dry ice, the provisions of these Technical Standardsapplicable to dry ice must be met in addition to the provisions set out in this packing instruction. The shipper must provide the operator with written documentation stating the number of packages of consumer commodities contained in each unit load device.

k) The gross mass on the dangerous goods transport document must be shown as:

   1) for one package, the actual gross mass of the package;

   2) for more than one package, either the actual gross mass of each package or as the average mass of the packages. (For example, if there are 10 packages and the total gross mass of them is 100 kg, the dangerous goods transport document may show this as “average gross mass per package 10 kg”.)

l) Packages prepared in accordance with these provisions must be durably and legibly marked with the mark shown in Figure 3-1.

COMBINATION PACKAGINGS					SINGLE PACKAGINGS	
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total quantity per package – passenger*	*Total quantity per package – cargo*	*Passenger*	*Cargo*
UN 1941 **Dibromodifluoromethane**	Metal	40.0 L	100 L	220 L	100 L	220 L
	Plastics	30.0 L				
	Glass	10.0 L				
UN 1990 **Benzaldehyde**	Metal	40.0 L	100 L	220 L	100 L	220 L
	Plastics	30.0 L				
	Glass	10.0 L				
UN 2315 **Polychlorinated biphenyls, liquid**	Metal	40.0 L	100 L	220 L	100 L	220 L
	Plastics	30.0 L				
	Glass	10.0 L				
UN 3082 **Environmentally hazardous substance, liquid, n.o.s.**	Metal	40.0 L	450 L	450 L	450 L	450 L
	Plastics	30.0 L				
	Glass	10.0 L				
UN 3151 **Polyhalogenated biphenyls, liquid** or **Polyhalogenated terphenyls, liquid** or **Halogenated monomethyldiphenyl-methanes, liquid**	Metal	40.0 L	100 L	220 L	100 L	220 L
	Plastics	30.0 L				
	Glass	10.0 L				
UN 3334 **Aviation regulated liquid, n.o.s.**	Metal	40.0 L	450 L	450 L	450 L	450 L
	Plastics	30.0 L				
	Glass	10.0 L				

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H1, 3H2)
Natural wood (4C1, 4C2)	Other metal (1N1, 1N2)	Steel (3A1, 3A2)
Other metal (4N)	Plastics (1H1, 1H2)	
Plastics (4H1, 4H2)	Steel (1A1, 1A2)	
Plywood (4D)		
Reconstituted wood (4F)		
Steel (4A)		

Composites	**Cylinders**	**Drums**	**Jerricans**
All (see 6;3.1.18)	See 4;2.7	Aluminium (1B1, 1B2)	Aluminium (3B1, 3B2)
		Other metal (1N1, 1N2)	Plastics (3H1, 3H2)
		Plastics (1H1, 1H2)	Steel (3A1, 3A2)
		Steel (1A1, 1A2)	

Packing Instruction Y964

Limited quantities
Passenger and cargo aircraft for UN 1941, UN 1990, UN 3082 and UN 3334 only

General requirements

SEGMENT 4, Section 1 requirements must be met (with the exception that the requirements of 4;1.1.2, 1.1.9 c), 1.1.9 e), 1.1.16, 1.1.18, 1.1.20 and in addition for UN 3082 the requirements of 4.1.1.6 do not apply). These requirements include:

1) **Compatibility requirements**

— Substances must be compatible with their packagings as required by 4;1.1.3.

2) **Closure requirements**

— Closures must meet the requirements of 4;1.1.4.

3) **Limited quantity requirements**

— SEGMENT 3, Section 4 requirements must be met including:

— the capability of the package to pass a 1.2 m drop test;
— a 24-hour stacking test; and
— inner packagings for liquids must be capable of passing a pressure differential test (4;1.1.6).

COMBINATION PACKAGINGS				**SINGLE PACKAGINGS**
UN number and proper shipping name	*Inner packaging (see 6;3.2)*	*Inner packaging quantity (per receptacle)*	*Total gross mass per package*	
UN 1941 **Dibromodifluoromethane** UN 1990 **Benzaldehyde** UN 3082 **Environmentally hazardous substance, liquid, n.o.s.** UN 3334 **Aviation regulated liquid, n.o.s.***	Metal	5.0 L	30 kg	No
	Plastics	5.0 L		
	Glass	5.0 L		

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	***Drums***	***Jerricans***
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Steel	
Plywood		
Reconstituted wood		
Steel		

UN number and proper shipping name		*Net quantity per package*	
		Passenger	*Cargo*
UN 3480	**Lithium ion batteries**	Forbidden	35 kg

Packing Instruction 965

IA.2 **Additional requirements**

- Cells and batteries must be protected against short circuits.
- Cells and batteries must be placed in inner packagings that completely enclose the cell or battery then placed in an outer packaging. The completed package for the cells or batteries must meet the Packing Group II performance requirements.
- Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
- A cell or battery with a mass of 12 kg or greater and having a strong, impact-resistant outer casing may be transported when packed in strong outer packagings or protective enclosures (such as in fully enclosed or wooden slatted crates) not subject to the requirements of Segment 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.
- Batteries manufactured after 31 December 2011 must be marked with the Watt-hour rating on the outside case.

IA.3 **Outer packagings**

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

IB. **SECTION IB**

Cells or batteries prepared in accordance with this section are subject to all of the applicable provisions of these Instructions (including the requirements in paragraph 2 of this packing instruction and of this section) except for the provisions of Segment 6.

Cells or batteries shipped in accordance with the provisions of Section IB must be described on a dangerous goods transport document as set in Segment 5;4. The packing instruction number “965” required by 5;4.1.5.8.1 a) must be supplemented with “IB”. All other applicable provisions of Segment 5;4 apply.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g) and the following:

1) for cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for batteries, the Watt-hour rating is not more than 100 Wh;
   - the Watt-hour rating must be marked on the outside of the battery case except for batteries manufactured before 1 January 2009;

IB.1 **General requirements**

- Cells and batteries must be packed in strong outer packagings that conform to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
- Cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

Table 965-IB

Contents	*Net quantity per package*	
	Cargo	*Passenger*
Lithium-ion cells and batteries	10 kg	Forbidden

Packing Instruction 965

IB.2 **Additional requirements**

— Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong rigid outer packaging.

≠ — Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).

— Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.

— Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  — damage to cells or batteries contained therein;
  — shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  — release of contents.

— Each package must be capable of withstanding, without damage to the cells or batteries contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours.

\+ *Note. — Capability may be demonstrated by testing, assessment or experience.*

≠ — Each package must be marked with the battery mark (Figure 5-3) in addition to the appropriate Class 9 hazard label (Figure 5-26) and the cargo aircraft only label (Figure 5-28).

IB.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

UN number and proper shipping name		*Package quantity (Section I)*	
		Cargo	*Passenger*
UN 3481	**Lithium ion batteries packed with equipment**	35 kg of cells or batteries	5 kg of cells or batteries

Packing Instruction 966

I.2 **Additional requirements**

- Cells and batteries must be protected against short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a packaging of a type shown below that meets the Packing Group II performance requirements, then placed with the equipment in a strong, rigid outer packaging; or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a packaging of a type shown below that meets the Packing Group II performance requirements.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- Batteries manufactured after 31 December 2011 must be marked with the Watt-hour rating on the outside case.

I.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

II. **SECTION II**

Cells and batteries packed with equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

- SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
- SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
- SEGMENT 7;4.4 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
- SEGMENT 7;4.5 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods);
- SEGMENT 8;1.1 (Provisions concerning passengers and crew – Dangerous goods carried by passengers or crew); and
- Paragraphs 1 and 2 of this packing instruction.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g) and the following:

1) for cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for batteries, the Watt-hour rating is not more than 100 Wh;
   – the Watt-hour rating must be marked on the outside case except for batteries manufactured before 1 January 2009.

Packing Instruction 966

II.1 **General requirements**

— **Until 31 December 2025**

Lithium ion cells and batteries should be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity.

— **From 1 January 2026**

— Lithium ion cells and batteries with a Watt-hour rating in excess of 2.7 Wh must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity.

— Lithium ion cells and/or batteries with a Watt-hour rating in excess of 2.7 Wh and at a state of charge exceeding 30 per cent of their rated capacity may only be offered for transport with the approval of the appropriate national authorities of the State of Origin and the State of the Operator under the written conditions established by those authorities. Such cells and/or batteries must be assigned to Class 9 and are subject to all applicable parts of these Instructions.

— Lithium ion cells and batteries with a Watt-hour rating not in excess of 2.7 Wh should be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

Table 966-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

II.2 **Additional requirements**

— Cells and batteries must:
  — be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  — be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
— Cells and batteries must be protected against short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
— The equipment must be secured against movement within the outer packaging.
— The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
— Each package of cells or batteries, or the completed package, must be capable of withstanding a 1.2 m drop test in any orientation without:
  — damage to cells or batteries contained therein;
  — shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  — release of contents.
— Each package of cells or batteries or the completed package must be capable of withstanding, without damage to the cells or batteries contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours.

Note.— Capability may be demonstrated by testing, assessment or experience.

Packing Instruction 966

— Each package must be marked with the battery mark (Figure 5-3).
  — the package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
— The words “lithium ion batteries, in compliance with Section II of PI966” must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
— Where a package contains a combination of batteries contained in equipment and batteries packed with equipment that meet the limits for cells or batteries of Section II, the following additional requirements apply:
  — the shipper must ensure that all applicable SEGMENTs of both packing Technical Standardsare met. The total mass of batteries contained in any package must not exceed 5 kg;
  — the words “lithium ion batteries, in compliance with Section II of PI966” must be placed on the air waybill, when an air waybill is used.
— Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

II.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

Packing Instruction 967

Passenger and cargo aircraft for UN 3481 (contained in equipment) only

1. **Introduction**

This entry applies to lithium ion or lithium polymer batteries contained in equipment.

Section I of this packing instruction applies to lithium ion and lithium polymer cells and batteries that are assigned to Class 9. Certain lithium ion and lithium polymer cells and batteries offered for transport and meeting the requirements of Section II of this packing instruction, subject to paragraph 2 below, are not subject to other additional requirements of these Instructions.

A single cell battery as defined in Segment III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a "cell" and must be transported according to the requirements for "cells" for the purpose of this packing instruction.

For the purpose of this packing instruction, "equipment" means apparatus for which the cells or batteries will provide electrical power for its operation.

2. **Batteries forbidden from transport**

The following applies to all cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

I. **SECTION I**

Each cell or battery must meet the provisions of 2;9.3.

I.1 **General requirements**

— Equipment should be offered for transport with:
  — the cells and batteries at a state of charge not exceeding 30 per cent of their rated capacity; or
  — an indicated battery capacity not exceeding 25 per cent.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

— Equipment must be packed in strong rigid outer packagings that conform to Segment 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Table 967-I

UN number and proper shipping name	*Package quantity (Section I)*	
	Cargo	*Passenger*
UN 3481 **Lithium-ion batteries contained in equipment**	35 kg of cells or batteries	5 kg of cells or batteries

I.2 **Additional requirements**

— The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
— Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
— Each package must be capable of withstanding, without damage to the equipment contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours. Large equipment that is offered for transport unpackaged or on pallets is not subject to the requirements for the 3 m stack test capability.

Note.— Capability may be demonstrated by testing, assessment or experience.

— Batteries manufactured after 31 December 2011 must be marked with the Watt-hour rating on the outside case.

Packing Instruction 967

I.3 **Outer packagings**

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood Steel		

II. **SECTION II**

Cells and batteries contained in equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

— SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
— SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
— SEGMENT 7;4.4 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
— SEGMENT 7;4.5 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods);
— SEGMENT 8;1.1 (Provisions concerning passengers and crew – Dangerous goods carried by passengers or crew); and
— Paragraphs 1 and 2 of this packing instruction.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e) and g) and the following:

1) for cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for batteries, the Watt-hour rating is not more than 100 Wh;
   — the Watt-hour rating must be marked on the outside of the battery case except for batteries manufactured before 1 January 2009.

Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.

II.1 **General requirements**

— Equipment should be offered for transport with:
  — the cells and batteries at a state of charge not exceeding 30 per cent of their rated capacity; or
  — an indicated battery capacity not exceeding 25 per cent.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

— Equipment must be packed in strong rigid outer packagings that conform to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Table 967-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

Packing Instruction 967

II.2 **Additional requirements**

- The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
- Cells and batteries must be protected so as to prevent short circuits.
- Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
- Each package must be capable of withstanding, without damage to the equipment contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours. Large equipment that is offered for transport unpackaged or on pallets is not subject to the requirements for the 3 m stack test capability.

  Note.— Capability may be demonstrated by testing, assessment or experience.

- Each package must be marked with the battery mark (Figure 5-3). The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
  - This requirement does not apply to:
    - packages containing only button cell batteries installed in equipment (including circuit boards); and
    - packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.
- Where a consignment includes packages bearing the battery mark (Figure 5-3), the words “lithium ion batteries, in compliance with Section II of PI967” must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

II.3 Outer packagings

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 Overpacks

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

UN number and proper shipping name		*Net quantity per package*	
		Cargo	*Passenger*
UN 3090	**Lithium metal batteries**	35 kg	Forbidden

Packing Instruction 968

IA.3 **Outer packagings**

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

IB. **SECTION IB**

Cells or batteries prepared in accordance with this section are subject to all of the applicable provisions of these Technical Standards(including the requirements in paragraph 2 of this packing instruction and of this section) except for the provisions of Segment 6.

Cells or batteries shipped in accordance with the provisions of Section IB must be described on a dangerous goods transport document as set in Segment 5;4. The packing instruction number “968” required by 5;4.1.5.8.1 a) must be supplemented with “IB”. All other applicable provisions of Segment 5;4 apply.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e), f) (if applicable) and g) and the following:

1) for cells, the lithium content is not more than 1 g;
2) for batteries, the aggregate lithium content is not more than 2 g.

IB.1 **General requirements**

Cells and batteries must be packed in strong outer packagings that conform to Segment 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).

Table 968-IB

Contents	*Net quantity per package*	
	Cargo	*Passenger*
Lithium metal cells and batteries	2.5 kg	Forbidden

IB.2 **Additional requirements**

- Cells and batteries must be packed in inner packagings that completely enclose the cell or battery then placed in a strong rigid outer packaging.
- Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
- Cells and batteries must be protected so as to prevent short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
- Each package must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be capable of withstanding, without damage to the cells or batteries contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours.

  Note.— Capability may be demonstrated by testing, assessment or experience.

- Each package must be marked with the battery mark (Figure 5-3) in addition to the appropriate Class 9 hazard label (Figure 5-26) and the cargo aircraft only label (Figure 5-28).

Packing Instruction 968

IB.3 **Outer packagings**

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

UN number and proper shipping name		*Package quantity (Section I)*	
		Cargo	*Passenger*
UN 3091	**Lithium metal batteries packed with equipment**	35 kg of cells or batteries	5 kg of cells or batteries

Packing Instruction 969

I.2 **Additional requirements**

- Cells and batteries must be protected against short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a packaging of a type shown below that meets the Packing Group II performance requirements, then placed with the equipment in a strong, rigid outer packaging; or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a packaging of a type shown below that meets the Packing Group II performance requirements.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- For lithium metal cells and batteries prepared for transport on passenger aircraft as Class 9:
  - cells and batteries offered for transport on passenger aircraft must be packed in intermediate or outer rigid metal packaging surrounded by cushioning material that is non-combustible and non-conductive and placed inside an outer packaging.

I.3 **Outer packagings**

Boxes	***Drums***	***Jerricans***
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

II. **SECTION II**

Cells and batteries packed with equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

- SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
- SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
- SEGMENT 7;4.4 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
- 92.01.29 to 41 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods);
- 92.01.3 (Provisions concerning passengers and crew – Dangerous goods carried by passengers or crew); and
- Paragraphs 1 and 2 of this packing instruction.

Lithium metal cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a),e), f) (if applicable) and g) and the following:

1) for cells, the lithium content is not more than 1 g;
2) for batteries, the aggregate lithium content is not more than 2 g.

II.1 **General requirements**

Table 969-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

Packing Instruction 969

II.2 **Additional requirements**

- Cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
- Cells and batteries must be protected against short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- Each package of cells or batteries, or the completed package, must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package of cells or batteries or the completed package must be capable of withstanding, without damage to the cells or batteries contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours.

  Note.— Capability may be demonstrated by testing, assessment or experience.

- Each package must be marked with the battery mark (Figure 5-3).
  - the package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
- The words "lithium metal batteries, in compliance with Section II of PI969" must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
- Where a package contains a combination of batteries contained in equipment and batteries packed with equipment that meet the limits for cells or batteries of Section II, the following additional requirements apply:
  - the shipper must ensure that all applicable SEGMENTs of both packing Technical Standardsare met. The total mass of batteries contained in any package must not exceed 5 kg;
  - the words "lithium metal batteries, in compliance with Section II of PI969" must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

II.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word "Overpack" in lettering of at least 12 mm high.

UN number and proper shipping name		*Package quantity (Section I)*	
		Cargo	*Passenger*
UN 3091	**Lithium metal batteries contained in equipment**	35 kg of cells or batteries	5 kg of cells or batteries

I.3 **Outer packagings**

Boxes	Drums	Jerricans
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II. **SECTION II**

Cells and batteries contained in equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

— SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
— SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
— 92.01.29 to 41 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
— 92.01.29 to 41 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods);
— 92.01.3 (Provisions concerning passengers and crew – Dangerous goods carried by passengers or crew); and
— Paragraphs 1 and 2 of this packing instruction.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.3 a), e), f) (if applicable) and g) and the following:

1) for cells, the lithium content is not more than 1 g;
2) for batteries, the aggregate lithium content is not more than 2 g.

Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.

II.1 **General requirements**

Equipment must be packed in strong rigid outer packagings that conform to Segment 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Table 970-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

Packing Instruction 970

II.2 **Additional requirements**

- The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
- Cells and batteries must be protected so as to prevent short circuits.
- Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
- Each package must be capable of withstanding, without damage to the equipment contained therein and without any reduction of effectiveness, a force applied to the top surface equivalent to the total weight of identical packages stacked to a height of 3 m (including the test sample) for a duration of 24 hours. Large equipment that is offered for transport unpackaged or on pallets is not subject to the requirements for the 3 m stack test capability.

  Note.— Capability may be demonstrated by testing, assessment or experience.

- Each package must be marked with the battery mark (Figure 5-3). The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
  - This requirement does not apply to:
    - packages containing only button cell batteries installed in equipment (including circuit boards); and
    - packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.
- Where a consignment includes packages bearing the battery mark (Figure 5-3), the words “lithium metal batteries, in compliance with Section II of PI970” must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

II.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

Packing Instruction 971

Passenger and cargo aircraft for UN 3499 only (see also Special Provision A186) and UN 3508 (Special Provision A196) only

General requirements

SEGMENT 4;1.1.1 and 1.1.8 requirements must be met.

For the purpose of this packing instruction, a capacitor is considered an inner packaging.

UN number and proper shipping name		*Quantity – Cargo*	*Quantity – Passenger*
UN 3499	**Capacitor**, electric double layer	No limit	No limit
UN 3508	**Capacitor, asymmetric** (with an energy storage capacity greater than 0.3 Wh)	No limit	No limit

ADDITIONAL PACKING REQUIREMENTS

For UN 3499

— Each capacitor must be transported in an uncharged state. The capacitor or, when fitted in a module, the module must be fitted with a metal strap connecting the terminals.
— Capacitors must be securely cushioned in the outer packagings.

OUTER PACKAGINGS OF COMBINATION PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Strong outer packagings		

Packing Instruction 972

Passenger or cargo aircraft for UN 3530 only
(See Packing Instruction 220 for flammable gas-powered engines and machinery, Packing Instruction 378 for flammable liquid-powered engines and machinery, Packing Instruction 950 for flammable liquid-powered vehicles, Packing Instruction 951 for flammable gas-powered vehicles or Packing Instruction 952 for battery-powered equipment and vehicles)

General requirements

Segment 4, Section 1 requirements must be met, including:

Compatibility requirements

— Substances must be compatible with their packagings as required by 4;1.1.3.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3530 **Engine, internal combustion** or **Machinery, internal combustion**	No limit	No limit

General

1) The engine or machinery, including the means of containment containing dangerous goods, must be in compliance with the construction requirements specified by the appropriate national authority;

2) Any valves or openings (such as venting devices) must be closed during transport;

3) The engines or machinery must be oriented to prevent inadvertent leakage of dangerous goods and secured by means capable of restraining the engines or machinery to prevent any movement during transport which would change the orientation or cause them to be damaged.

ADDITIONAL PACKING REQUIREMENTS

If the engine or machinery is constructed and designed so that the means of containment containing the dangerous goods affords adequate protection, an outer packaging is not required. Dangerous goods in engines or machinery must otherwise be packed in outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, and meeting the applicable requirements of 4;1.1.1, or they must be fixed in such a way that they will not become loose during normal conditions of transport, such as in cradles or crates or other handling devices.

Liquid fuel tanks

Except as otherwise provided for in this packing instruction, fuel tanks must be drained of fuel and tank caps fitted securely. Special precautions are necessary to ensure complete drainage of the fuel system of machines or equipment incorporating internal combustion engines, such as lawn mowers and outboard motors, where such machines or equipment could possibly be handled in other than an upright position. When it is not possible to handle in other than an upright position, machinery must be drained of fuel as far as practicable, and if any fuel remains, it must not exceed one-quarter of the tank capacity.

Batteries

All batteries must be installed and securely fastened in the battery holder of the machine or equipment and must be protected in such a manner so as to prevent damage and short circuits. In addition:

1) If spillable batteries are installed, and it is possible for the machine or equipment to be handled in such a way that batteries would not remain in their intended orientation, they must be removed and packed according to Packing Instruction 870.

2) If lithium batteries are installed:

   i) lithium batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport; and

   ii) they must meet the provisions of SEGMENT 2;9.3, except that pre-production prototypes of lithium batteries or cells, when these prototypes are transported for testing, or low production runs of lithium batteries or cells that have not been tested to the requirements in Part III, subsection 38.3 of the UN *Manual of Tests and Criteria* may be transported aboard cargo aircraft if approved by the appropriate authority of the State of Origin and the State of the Operator. A copy of the document of approval must accompany the consignment.

3) If metallic sodium or sodium alloy batteries are installed, they must conform to the requirements of Special Provision A94.

Packing Instruction 972

Other operational equipment

Dangerous goods required for the operation or safety of the machine or equipment, such as fire extinguishers, tire inflation canisters or safety devices, must be securely mounted in the machine or equipment.

Packing Instruction 975

Passenger and cargo aircraft for UN 3548 only

Introduction

This packing instruction is only permitted for articles which do not have an existing proper shipping name and which contain only environmentally hazardous substances where the quantity of the environmentally hazardous substance in the article exceeds 5 L or 5 kg. In addition to the environmentally hazardous substances, the article may also contain lithium cells or batteries that comply with Section II of Packing Instruction 967 or Section II of Packing Instruction 970, as applicable.

General requirements

SEGMENT 4;1.1.1, 4;1.1.3, 4;1.1.12 and 4;2 requirements must be met.

UN number and proper shipping name	*Quantity – Cargo*	*Quantity – Passenger*
UN 3548 **Articles containing miscellaneous dangerous goods, n.o.s.***	No limit	No limit

ADDITIONAL PACKING REQUIREMENTS

— Packagings must meet the Packing Group II performance requirements.
— Receptacles containing liquids or solids within articles must be constructed of suitable materials and secured in the article in such a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the article itself or the outer packaging.
— Receptacles containing liquids with closures must be packed with their closures correctly oriented. The receptacles must in addition conform to the internal pressure test provisions of 6;4.5.
— Receptacles that are liable to break or be punctured easily, such as those made of glass or of certain plastics materials must be properly secured, and any leakage of the contents must not substantially impair the protective properties of the article or of the outer packaging.
— Where there is no receptacle within the article, the article must fully enclose the dangerous goods and prevent their release under normal conditions of transport.
— Articles must be packed to prevent movement and inadvertent operation during normal conditions of transport.

ROBUST ARTICLES

Robust articles may alternatively be transported in strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packaging capacity and its intended use. The packagings must achieve a level of protection that is at least equivalent to that provided by 6;1. Articles may be transported unpackaged or on pallets when the dangerous goods are afforded equivalent protection by the article in which they are contained. In such cases, the additional requirement related to Packing Group II performance requirements and the requirement for UN specification packagings do not apply.

OUTER PACKAGINGS (see 6;3.1)

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 976

Cargo aircraft only for UN 3551

1. **Introduction**

This entry applies to sodium ion batteries.

A single cell battery as defined in SEGMENT III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a “cell” and must be transported according to the requirements for “cells” for the purpose of this packing instruction.

2. **Batteries forbidden from transport**

The following applies to all cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

Waste cells or batteries and cells or batteries being shipped for recycling or disposal are forbidden from air transport unless approved by the appropriate national authority of the State of Origin and the State of the Operator.

3. **General requirements**

— Each cell or battery must meet the provisions of 2;9.4.
— SEGMENT 4;1 requirements must be met.
— Cells and batteries must be offered for transport at a state of charge not exceeding 30 per cent of their rated capacity. Cells and/or batteries at a state of charge greater than 30 per cent of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Note.— Guidance and methodology for determining the rated capacity can be found in sub-section 38.3.2.3 of the UN Manual of Tests and Criteria*. Cells and batteries shipped at a reduced state of charge are less prone to thermal runaway.*

— Batteries manufactured after 31 December 2025 must be marked with the Watt-hour rating on the outside case.

4. **Additional requirements**

— Cells and batteries must be protected against short circuits.
— Cells and batteries must be placed in inner packagings that completely enclose the cell or battery then placed in an outer packaging. The completed package for the cells or batteries must meet the Packing Group II performance requirements.
— Cells and batteries must not be packed in the same outer packaging with substances and articles of Class 1 (explosives) other than Division 1.4S, Division 2.1 (flammable gases), Class 3 (flammable liquids), Division 4.1 (flammable solids) or Division 5.1 (oxidizers).
— A cell or battery with a mass of 12 kg or greater and having a strong, impact-resistant outer casing may be transported when packed in strong outer packagings or protective enclosures (such as in fully enclosed or wooden slatted crates) not subject to the requirements of SEGMENT 6 of these Instructions, if approved by the appropriate authority of the State of Origin. A copy of the document of approval must accompany the consignment.

Table 976

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3551 **Sodium ion batteries**	Forbidden	35 kg

Packing Instruction 976

5. **Outer packagings**

Boxes	Drums	Jerricans
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

Packing Instruction 977

Passenger and cargo aircraft only for UN 3552 (packed with equipment) only

1. **Introduction**

This entry applies to sodium ion batteries packed with equipment.

Section I of this packing instruction applies to sodium ion cells and batteries that are assigned to Class 9. Certain sodium ion cells and batteries offered for transport and meeting the requirements of Section II of this packing instruction, subject to paragraph 2 below, are not subject to other additional requirements of these Instructions.

A single cell battery as defined in SEGMENT III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a “cell” and must be transported according to the requirements for “cells” for the purpose of this packing instruction.

For the purpose of this packing instruction, “equipment” means apparatus for which the cells or batteries will provide electrical power for its operation.

2. **Batteries forbidden from transport**

The following applies to all cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

I. **SECTION I**

Each cell or battery must meet the provisions of 2;9.4.

I.1 **General requirements**

— SEGMENT 4;1 requirements must be met.

Table 977-I

UN number and proper shipping name		*Net quantity per package*	
		Passenger	*Cargo*
UN 3552	**Sodium ion batteries packed with equipment**	5 kg of sodium ion cells or batteries	35 kg of sodium ion cells or batteries

Packing Instruction 977

I.2 **Additional requirements**

- Cells and batteries must be protected against short circuits. This includes protection against contact with conductive materials within the same packaging that could lead to a short circuit.
- Cells or batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a packaging of a type shown below that meets the Packing Group II performance requirements, then placed with the equipment in a strong, rigid outer packaging; or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a packaging of a type shown below that meets the Packing Group II performance requirements.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- Batteries manufactured after 31 December 2025 must be marked with the Watt-hour rating on the outside case.

I.3 **Outer packagings**

Boxes	**Drums**	**Jerricans**
Aluminium (4B)	Aluminium (1B2)	Aluminium (3B2)
Fibreboard (4G)	Fibre (1G)	Plastics (3H2)
Natural wood (4C1, 4C2)	Other metal (1N2)	Steel (3A2)
Other metal (4N)	Plastics (1H2)	
Plastics (4H1, 4H2)	Plywood (1D)	
Plywood (4D)	Steel (1A2)	
Reconstituted wood (4F)		
Steel (4A)		

II. SECTION II

Cells and batteries packed with equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

- SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
- SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
- 92.01.29 to 41 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
- 92.01.29 to 41 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods); ; and
- Paragraphs 1 and 2 of this packing instruction.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.4 a), e) and f) and the following:

1) for cells, the Watt-hour rating (see the Glossary of terms in Attachment 2) is not more than 20 Wh;

2) for batteries, the Watt-hour rating is not more than 100 Wh.
   - the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2026.

II.1 **General requirements**

Table 977-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

Packing Instruction 977

II.2 **Additional requirements**

- Cells and batteries must:
  - be placed in inner packagings that completely enclose the cell or battery, then placed in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1); or
  - be placed in inner packagings that completely enclose the cell or battery, then placed with the equipment in a strong rigid outer packaging that conforms to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1).
- Cells and batteries must be protected against short circuits. This includes protection against contact with electrically conductive material within the same packaging that could lead to a short circuit.
- The equipment must be secured against movement within the outer packaging.
- The number of cells or batteries in each package must not exceed the number required for the equipment's operation, plus two spare sets. A "set" of cells or batteries is the number of individual cells or batteries that are required to power each piece of equipment.
- Each package of cells or batteries, or the completed package, must be capable of withstanding a 1.2 m drop test in any orientation without:
  - damage to cells or batteries contained therein;
  - shifting of the contents so as to allow battery to battery (or cell to cell) contact;
  - release of contents.
- Each package must be marked with the battery mark (Figure 5-3).
  - the package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
- The words "sodium ion batteries, in compliance with Section II of PI977" must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
- Where a package contains a combination of batteries contained in equipment and batteries packed with equipment that meet the limits for cells or batteries of Section II, the following additional requirements apply:
  - the shipper must ensure that all applicable parts of both packing Technical Standardsare met. The total mass of batteries contained in any package must not exceed 5 kg;
  - the words "sodium ion batteries, in compliance with Section II of PI977" must be placed on the air waybill, when an air waybill is used.
- Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with their responsibilities.

II.3 **Outer packagings**

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word "Overpack" in lettering of at least 12 mm high.

Packing Instruction 978

Passenger and cargo aircraft only for UN 3552 (contained in equipment) only

1. **Introduction**

This entry applies to sodium ion batteries contained in equipment.

Section I of this packing instruction applies to sodium ion cells and batteries that are assigned to Class 9. Certain sodium ion cells and batteries offered for transport and meeting the requirements of Section II of this packing instruction, subject to paragraph 2 below, are not subject to other additional requirements of these Instructions.

A single cell battery as defined in Part III, sub-section 38.3.2.3 of the UN *Manual of Tests and Criteria* is considered a “cell” and must be transported according to the requirements for “cells” for the purpose of this packing instruction.

For the purpose of this packing instruction, “equipment” means apparatus for which the cells or batteries will provide electrical power for its operation.

2. **Batteries forbidden from transport**

The following applies to all cells and batteries in this packing instruction:

Cells or batteries identified as being damaged or defective in accordance with Special Provision A154 are forbidden for transport.

I. **SECTION I**

Each cell or battery must meet the provisions of 2;9.4.

I.1 **General requirements**

Equipment must be packed in strong rigid outer packagings that conform to SEGMENT 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Table 978-I

UN number and proper shipping name	*Net quantity per package*	
	Passenger	*Cargo*
UN 3552 **Sodium ion batteries contained in equipment**	5 kg of sodium ion cells or batteries	35 kg of sodium ion cells or batteries

I.2 **Additional requirements**

- The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
- Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
- Batteries manufactured after 31 December 2025 must be marked with the Watt-hour rating on the outside case.

I.3 **Outer packagings**

Boxes	*Drums*	*Jerricans*
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

Packing Instruction 978

II. SECTION II

Cells and batteries contained in equipment, when complying with Section II of this packing instruction, are only subject to the following additional provisions of these Instructions:

— SEGMENT 1;2.3 (General – Transport of dangerous goods by post);
— SEGMENT 5;2.4.16 (Shipper's responsibilities – Special marking requirements for lithium batteries or sodium ion batteries);
— 92.01.29 to 41 (Operator's responsibilities – Reporting of dangerous goods accidents and incidents);
— 92.01.29 to 41 (Operator's responsibilities – Reporting of undeclared and misdeclared dangerous goods); ; and
— Paragraphs 1 and 2 of this packing instruction.

Cells and batteries may be offered for transport provided that each cell and battery meets the provisions of 2;9.4 a), e) and f) and the following:

1) for cells, the Watt-hour rating (see the Glossary of Terms in Attachment 2) is not more than 20 Wh;

2) for batteries, the Watt-hour rating is not more than 100 Wh;
   — the Watt-hour rating must be marked on the outside of the battery case except for those batteries manufactured before 1 January 2026.

Devices such as radio frequency identification (RFID) tags, watches and temperature loggers, which are not capable of generating a dangerous evolution of heat, may be transported when intentionally active. When active, these devices must meet defined standards for electromagnetic radiation to ensure that the operation of the device does not interfere with aircraft systems. The devices must not be capable of emitting disturbing signals (such as buzzing alarms, strobe lights, etc.) during transport.

II.1 General requirements

Equipment must be packed in strong rigid outer packagings that conform to Segment 4;1.1.1, 1.1.3.1 and 1.1.10 (except 1.1.10.1). Large equipment can be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

Table 978-II

Contents	*Package quantity (Section II)*	
	Cargo	*Passenger*
Net quantity of cells or batteries per package	5 kg	5 kg

II.2 Additional requirements

— The equipment must be secured against movement within the outer packaging and must be equipped with an effective means of preventing accidental activation.
— Cells and batteries must be protected so as to prevent short circuits.
— Where multiple pieces of equipment are packed in the same outer packaging, each piece of equipment must be packed to prevent contact with other equipment.
— Each package must be marked with the battery mark (Figure 5-3). The package must be of such size that there is adequate space to affix the mark on one side without the mark being folded.
   — This requirement does not apply to:
      — packages containing only button cell batteries installed in equipment (including circuit boards); and
      — packages containing no more than four cells or two batteries installed in equipment, where there are not more than two packages in the consignment.
— Where a consignment includes packages bearing the battery mark (Figure 5-3), the words "sodium ion batteries, in compliance with Section II of PI978" must be placed on the air waybill, when an air waybill is used. Where packages of Section II batteries from multiple packing Technical Standardsare included on one air waybill, the compliance statement for the different battery types and/or packing Technical Standardsmay be combined into a single statement provided that the statement identifies the applicable battery type(s) and packing instruction numbers.
— Any person preparing or offering cells or batteries for transport must receive adequate instruction on these requirements commensurate with the functions for which they are responsible.

Packing Instruction 978

II.3 **Outer packagings**

Boxes	**Drums**	**Jerricans**
Aluminium	Aluminium	Aluminium
Fibreboard	Fibre	Plastics
Natural wood	Other metal	Steel
Other metal	Plastics	
Plastics	Plywood	
Plywood	Steel	
Reconstituted wood		
Steel		

II.4 **Overpacks**

When packages are placed in an overpack:

a) the packages must be secured within the overpack;

b) the intended function of each package must not be impaired by the overpack; and

c) the battery mark (Figure 5-3) required by this packing instruction must either be clearly visible or the mark must be reproduced on the outside of the overpack and the overpack must be marked with the word “Overpack” in lettering of at least 12 mm high.

SEGMENT 5

SHIPPER'S RESPONSIBILITIES

SEGMENT 5

Section1

SHIPPER'S RESPONSIBILITIES

1. Before a person offers any package or overpack of dangerous goods for transport by air, that person must ensure that:

a) the articles or substances are not forbidden for transport by air;

b) the goods are properly classified, marked and labelled and otherwise in a condition for transport as required by these Instructions;

c) the dangerous goods are packaged in compliance with all the applicable air transport requirements including:

I. inner packaging and the maximum quantity per package limits;

II. appropriate types of packaging according to the packing instructions;

III. other applicable requirements indicated in the packing instructions including:

— single packagings may be forbidden;
— only inner and outer packagings indicated in the packing instructions are permitted;
— inner packaging may need to be packed in intermediate packagings; and
— certain dangerous goods must be transported in packagings meeting a higher performance level.

IV. appropriate closure procedures for inner and outer packagings;

V. the compatibility requirements such as those in the particular packing requirements of the packing instructions and in Segment 4, Section 1;

VI. the absorbent material requirements in the packing instructions when applicable; and

VII. the pressure differential requirement in Segment 4;1.

d) the dangerous goods transport document has been properly executed and the declaration signed;

e) the overpack does not contain packages of dangerous goods which require segregation according to Table 92.01.29.1;

f) when an overpack is used, packages must be secured within the overpack;

g) the dangerous goods are not included in any freight container/unit load device except as specified in 92.01.29 to 41;

h) before a package or overpack is reused, all inappropriate dangerous goods labels and marks are removed or completely obliterated;

i) each package contained within an overpack is properly packed, marked, labelled and is free of any indication that its integrity has been compromised and in all respects is properly prepared as required in these Instructions. The "overpack" mark is an indication of compliance with this requirement. The intended function of each package must not be impaired by the overpack; and

j) packages and overpacks containing dangerous goods are offered to the operator separately from cargo which is not subject to these Instructions, except as provided for in 92.01.29 to 41.

2. In addition to the approval of package designs described in Segment 6;4, multilateral shipment approval is also required in certain circumstances. In some circumstances it is also necessary to notify competent authorities of a shipment.

   a) The shipment of Type B(M) packages not conforming with the requirements of Segment 6;7;

   b) The shipment of Type B(M) packages containing radioactive material with an activity greater than 3000 A_1 or 3000 A_2, as appropriate, or 1000 TBq, whichever is the lower; and

   c) The shipment of packages containing fissile materials if the sum of the criticality safety indexes of the packages in a single freight container or in an aircraft exceeds 50;

   except that a competent authority may authorize transport into or through its country without shipment approval, by a specific provision in its design approval.

3. A competent authority may approve provisions under which consignments that do not satisfy all the applicable requirements of these Instructions may be transported under special arrangement.

   Notification to competent authorities is required as follows:

   a) Before the first shipment of any package requiring competent authority approval, the shipper must ensure that copies of each applicable competent authority certificate applying to that package design have been submitted to the competent authority of the country of origin of the shipment and to the competent authority of each country through or into which the consignment is to be transported. The shipper is not required to await an acknowledgement from the competent authority, nor is the competent authority required to make such acknowledgement of receipt of the certificate;

   b) For each of the following types of shipments:

      i) Type C packages containing radioactive material with an activity greater than 3000 A_1 or 3000 A_2, as appropriate, or 1000 TBq, whichever is the lower;

      ii) Type B(U) packages containing radioactive material with an activity greater than 3000 A_1 or 3000 A_2, as appropriate, or 1000 TBq, whichever is the lower;

      iii) Type B(M) packages;

      iv) Shipment under special arrangement;

the shipper must notify the competent authority of the country of origin of the shipment and the competent authority of each country through or into which the consignment is to be transported. This notification must be in the possession of each competent authority prior to the commencement of the shipment, and preferably at least 7 days in advance;

c) The shipper is not required to send a separate notification if the required information has been included in the application for approval of shipment;
d) The consignment notification must include:
e) sufficient information to enable the identification of the package or packages including all applicable certificate numbers and identification marks;
f) information on the date of shipment, the expected date of arrival and proposed routeing;
g) the names of the radioactive material or nuclides;
h) descriptions of the physical and chemical forms of the radioactive material, or whether it is special form radioactive material or low dispersible radioactive material; and
i) the maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with an appropriate SI prefix symbol. For fissile material, the mass of fissile material (or of each fissile nuclide for mixtures when appropriate) in units of grams (g), or multiples thereof, may be used in place of activity.

4. Certificates issued by the competent authority are required for the following:

a) Designs for:

i) special form radioactive material;

ii) low dispersible radioactive material;

iii) fissile material as excepted;

iv) packages containing 0.1 kg or more of uranium hexafluoride;

v) packages containing fissile material unless excepted;

vi) Type B(U) packages and Type B(M) packages;

vii) Type C packages;

b) Special arrangements;

c) Certain shipments.

d) Determination of the basic radionuclide values referred to in Segment 2;7 for individual radionuclides which are not listed in Table 2-12;

e) Alternative activity limits for an exempt consignment of instruments or articles;

The certificates must confirm that the applicable requirements are met, and for design approvals, must attribute to the design an identification mark.

The certificates of approval for the package design and shipment may be combined into a single certificate. Certificates and applications for these certificates must be in accordance with the requirements in 6;7.

1.1.1.1 The shipper must be in possession of a copy of each applicable certificate.

1.1.1.2 For package designs where it is not required that a competent authority issue a certificate of approval, the shipper must, on request, make available for inspection by the relevant competent authority, documentary evidence of the compliance of the package design with all the applicable requirements.

5. The transport index (TI) for a package, overpack or freight container, must be the number derived in accordance with the following procedure:

   a) Determine the maximum dose rate in units of millisieverts per hour (mSv/h) at a distance of 1 m from the external surfaces of the package, overpack, or freight container. The value determined must be multiplied by 100 and the resulting number is the transport index. For uranium and thorium ores and their concentrates, the maximum dose rate at any point 1 m from the external surface of the load may be taken as:

      0.4 mSv/h for ores and physical concentrates of uranium and thorium;

      0.3 mSv/h for chemical concentrates of thorium;

      0.02 mSv/h for chemical concentrates of uranium, other than uranium hexafluoride;

   b) For freight containers, the value determined in step a) above must be multiplied by the appropriate factor from Table 5-1;

   c) The value obtained in steps a) and b) above must be rounded up to the first decimal place (such as 1.13 becomes 1.2), except that a value of 0.05 or less may be considered as zero and the resulting number is the transport index value.

1.1.1.2.1 The transport index for each overpack or freight container must be determined as the sum of the transport indices of all the packages contained therein. However, for a rigid overpack, or a freight container from one single shipper, the shipper may determine the transport index by direct measurement of dose rate. The transport index for a non-rigid overpack must be determined only as the sum of the transport indices of all the packages within the overpack.

6. **Determination of transport index**

Table 5-1. Multiplication factors for freight containers

*Size of load**	*Multiplication factor*
size of load ≤ 1 m^2 1 m^2 < size of load ≤ 5 m^2 5 m^2 < size of load ≤ 20 m^2 20 m^2 < size of load	1 2 3 10
* Largest cross-sectional area of the load being measured.	

7. The criticality safety index for each overpack or freight container must be determined as the sum of the CSIs of all the packages contained. The same procedure must be followed for determining the total sum of CSIs in a consignment or aboard an aircraft.

8. Packages, overpacks and freight containers must be assigned to either category I-WHITE, II-YELLOW or III-YELLOW in accordance with the conditions specified in Table 5-2 and with the following requirements:

a) for a package, overpack or freight container, both the transport index and the surface dose rate conditions must be taken into account in determining which is the appropriate category. Where the transport index satisfies the condition for one category but the surface dose rate satisfies the condition for a different category, the package, overpack or freight container must be assigned to the higher category. For this purpose, category I-WHITE must be regarded as the lowest category;

b) the transport index must be determined following the procedures specified;

c) if the surface dose rate is greater than 2 mSv/h, the package or overpack must be transported under exclusive use and under the provisions of 92.01.29 to 41, as appropriate;

d) a package transported under a special arrangement must be assigned to category III-YELLOW except under the provisions of Segment 1;

e) an overpack or freight container which contains packages transported under special arrangement must be assigned to category III-YELLOW except under the provisions.

9. Categories of packages, overpacks and freight containers

Conditions		
Transport index	*Maximum dose rate at any point on external surface*	*Category*
0*	Not more than 0.005 mSv/h	I-WHITE
More than 0 but not more than 1*	More than 0.005 mSv/h but not more than 0.5 mSv/h	II-YELLOW
More than 1 but not more than 10	More than 0.5 mSv/h but not more than 2 mSv/h	III-YELLOW
More than 10	More than 2 mSv/h but not more than 10 mSv/h	III-YELLOW**
* If the measured transport index is not greater than 0.05, the value quoted may be zero in accordance with 1.2.3.1.1 c). ** Must be transported under exclusive use and special arrangement except for freight containers (see Table 7-6).		

10. In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the categorization must be in accordance with the certificate of the country of origin of design.
11. Excepted packages of radioactive material of Class 7 must be legibly and durably marked on the outside of the packaging with:

a) the UN number preceded by the letters “UN”;

b) an identification of either the shipper or consignee, or both; and

c) the permissible gross mass if this exceeds 50 kg

12. The documentation requirements of Segment 5;4 do not apply to excepted packages of radioactive material of Class 7, except that:

a) the UN number preceded by the letters “UN” and the name and address of the shipper and the consignee and, if relevant, the identification mark for each competent authority certificate of approval must be shown on a transport document such as an air waybill or other similar document complying with the requirements of Segment 5;

b) the requirements, if relevant, of Segment 4 apply; and

c) the requirements of Segment 4.4 apply.

13. Where an agreement exists with the operator, the shipper may provide the information by EDP or EDI techniques.

14. A shipper must provide such information to employees as will enable them to carry out the functions for which they are responsible with regard to the transport of dangerous goods by air.

15. Before a consignment of dangerous goods is offered for air transport, all relevant persons involved in its preparation must have received training to enable them to carry out the functions for which they are responsible, as detailed in Segment 1. Where a shipper does not have trained staff, the “relevant persons” may be interpreted as applying to those employed to act on the shipper’s behalf and to undertake the shipper’s responsibilities in the preparation of the consignment. However, such persons must be trained as required by Segment 1, Section 4.

16. Before a person offers any salvage packaging for transport by air, that person must ensure that:

it is marked with the proper shipping name and UN number of, and bear all the labels appropriate for, the dangerous goods contained therein;

it is marked with the word “Salvage” and the lettering of the “Salvage” mark must be at least 12 mm high;

17. the words “Salvage packaging” are added after the description of the goods in the dangerous goods transport document as required; and

18. where the package contains dangerous goods restricted to transport on cargo aircraft only, it bears a “Cargo aircraft only” label and the dangerous goods transport document contains the necessary statement.

In addition, that person must ensure that all other applicable requirements are met.

19. Other than for Class 7, a packaging which previously contained dangerous goods must be identified, marked, labelled and placarded as required for those dangerous goods unless steps such as cleaning, purging of vapours or refilling with a non-dangerous substance are taken to nullify any hazard.

Before an empty packaging which had previously contained an infectious substance is returned to the shipper, or sent elsewhere, it must be disinfected or sterilized to nullify any hazard, and any label or mark indicating that it had contained an infectious substance must be removed or obliterated.

20. Freight containers as well as other packagings and overpacks used for the transport of radioactive material must not be used for the storage or transport of other goods unless decontaminated below the level of 0.4 Bq/cm2 for beta and gamma emitters and low toxicity alpha emitters and 0.04 Bq/cm2 for all other alpha emitters.

21. When two or more dangerous goods are packed within the same outer packaging, the package must be labelled and marked as required for each substance. Labels need not be applied for a subsidiary hazard if the hazard is already represented by a primary hazard label.

Segment 5 Section 2

MARKING

1. Unless otherwise provided in these Instructions, packages of dangerous goods and overpacks containing dangerous goods offered for transport by air must be marked as required by this Chapter.

2. All marks must be so placed on the packagings that they are not covered or obscured by any part of or attachment to the packaging or any other label or mark.

3. All package marks required:

   a) must be durable and printed or otherwise marked on, or affixed to, the external surface of the package;

   b) must be readily visible and legible;

   c) must be able to withstand open weather exposure without a substantial reduction in effectiveness;

   d) must be displayed on a background of contrasting colour; and

   e) must not be located with other package marks that could substantially reduce their effectiveness.

4. The marks required by 2.4.9 (Figure 5-2) and 2.4.16 (Figure 5-3) must be applied on one side of the package.

5. Arrows for purposes other than indicating proper package orientation must not be displayed on a package containing liquid dangerous goods.

6. Unless otherwise provided in these Instructions, the proper shipping name of the dangerous goods (supplemented with the technical name(s) if appropriate, see Part 3, Chapter 1) and, when assigned, the corresponding UN or ID number preceded by the letters “UN” or “ID”, as appropriate, must be displayed on each package. The UN or ID number and the letters “UN” or “ID” must be at least 12 mm high, except for packagings of 30 L capacity or less or of 30 kg maximum net mass and for cylinders of 60 L water capacity or less, when they must be at least 6 mm in height and except for packagings of 5 L capacity or less or of 5 kg maximum net mass when they must be of an appropriate size. In the case of unpackaged articles, the mark must be displayed on the article, on its cradle or on its handling, storage or launching device. A typical package mark would be:

   “Corrosive liquid, acidic, organic, n.o.s. (caprylyl chloride) UN 3265”.

7. For solid substances, unless the word “molten” is already included in the proper shipping name, it must be added to the proper shipping name on the package when a substance is offered for air transport in the molten state.

8. The name and address of the person who offers the dangerous goods for transport by air and of the consignee must be provided on each package and should be located on the same surface of the package near the proper shipping name mark, if the package dimensions are adequate.

9. The proper shipping name required may be supplemented by additional descriptive text to indicate commercial or military names.

10. Each outer or single packaging used for dangerous goods, for which specification packaging is required in Part 4, must bear the marks appropriate to the contents as specified in Part 6, Chapter 2.

11. Marks must be stamped, printed or otherwise marked on the package to provide adequate permanency.

12. Special marking requirements for radioactive material

13. The marking of excepted packages of radioactive material of Class 7 must be as required.

14. Each package of gross mass exceeding 50 kg must have its permissible gross mass legibly and durably marked on the outside of the packaging.

15. Each package which conforms to:

    a) a Type IP-1 package, a Type IP-2 package or a Type IP-3 package design must be legibly and durably marked on the outside of the packaging with “TYPE IP-1”, “TYPE IP-2” or “TYPE IP-3” as appropriate;

    b) a Type A package design must be legibly and durably marked on the outside of the packaging with “TYPE A”;

    c) a Type IP-2 package, a Type IP-3 package or a Type A package design must be legibly and durably marked on the outside of the packaging with the international vehicle registration code (VRI Code) of the country of origin of design and either the name of the manufacturer, or other identification of the packaging specified by the competent authority of the country of origin of design.

16. Each package which conforms to a design approved under the UN Model Regulations must be legibly and durably marked on the outside of the package with the following information:

    a) the identification mark allocated to that design by the competent authority;

    b) a serial number to uniquely identify each packaging which conforms to that design; and

    c) “Type B(U)”, “Type B(M)” or “Type C” in the case of a Type B(U), Type B(M) or Type C package design.

17. Each package which conforms to a Type B(U), Type B(M) or Type C package design must have the outside of the outermost receptacle which is resistant to the effects of fire and water plainly marked by embossing, stamping or other means resistant to the effects of fire and water with the trefoil symbol, as shown in Figure 5-1 below. Any mark on the package made in relating to the package type that does not relate to the UN number and proper shipping name must be removed or covered.

18. In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the mark must be in accordance with the certificate of the country of origin of the design.

19. Special marking requirements for refrigerated liquefied gas

The upright position of each package must be indicated prominently by either the “Package orientation” label (Figure 5-29) or pre-printed package orientation labels meeting the same specification as either Figure 5-29 or ISO Standard 780:1997. The label must be affixed to or printed on at least two opposite vertical sides of the package with the arrows pointing in the correct direction. The wording “KEEP UPRIGHT” must be placed at 120□ intervals around the package or on each side. Packages must also be clearly marked

"DO NOT DROP – HANDLE WITH CARE".

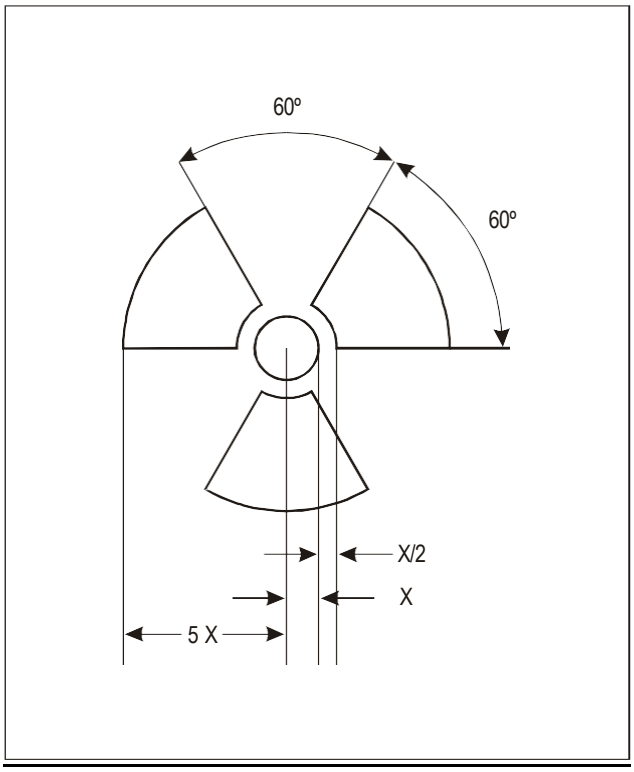


Figure 5-1. Basic trefoil symbol with proportions based on a central circle of radius X. The minimum allowable size of X must be 4 mm.

20. The net mass of solid carbon dioxide (dry ice) must be marked on any package containing such substance.
21. Special marking requirement for biological substances, Category B
22. Packages containing biological substances, Category B packed in accordance with Packing Instruction 650 must be marked "Biological substance, Category B".
23. Special marking provisions for environmentally hazardous substances
24. Unless otherwise specified in these Instructions, packages containing environmentally hazardous substances meeting the criteria of 2;9.2 a) (UN Nos. 3077 and 3082) must be durably marked with the environmentally hazardous substance mark and the packages must also bear a Class 9 hazard label.
25. The environmentally hazardous substance mark must be as shown in Figure 5-2. The mark must be in the form of a square set at an angle of 45° (diamond-shaped). The symbol (fish and tree) must be black on white or suitable contrasting background. The minimum dimensions must be 100 mm × 100 mm and the minimum width of line forming the diamond must be 2 mm. If the size of the package so requires, the dimensions/line thickness may be reduced, provided the mark remains clearly visible. Where dimensions are not specified, all features must be in approximate proportion to those shown.

Figure 5-2. Symbol (fish and tree): black on white or suitable contrasting background

26. Unless marks and labels representative of all dangerous goods in the overpack are visible, the overpack must be:

a) marked with the word “OVERPACK”. The lettering of the “OVERPACK” mark must be at least 12 mm high; and

b) labelled and marked with the proper shipping name, UN number and other marks, as required for packages in accordance with this chapter and Chapter 3, for each item of dangerous goods contained in the overpack.

c) Packaging specification marks must not be reproduced on the overpack.

27. Additional marks of packages containing dangerous goods in limited quantities

28. Marks required by other international or national transport regulations are permitted in addition to marks required by these Instructions, provided that they cannot be confused with or conflict with any marks prescribed by these Instructions, because of their colour, design or shape.

29. When chemical oxygen generators contained in protective breathing equipment (PBE) are being transported under Special Provision A144, the statement “Aircrew protective breathing equipment (smoke hood) in accordance with Special Provision A144” shall be marked adjacent to the proper shipping name on the package.

30. Intermediate bulk containers must comply with the marking requirements applicable to other packagings, except that intermediate bulk containers of more than 450 L capacity must be marked with the proper shipping name and UN number, as required in 2.4.1, and the environmentally hazardous substance mark, on two opposite sides.

31. Packages containing lithium cells or batteries, or sodium ion cells or batteries, prepared in accordance with Section II of Packing Instructions 966, 967, 969, 970, 977 or 978 and Section IB of Packing Instructions 965 and 968 must be marked as shown in Figure 5-3.

2.4.16.2 The mark must indicate the appropriate UN number preceded by the letters “UN” as follows:

a) “UN 3090” for lithium metal cells or batteries;

b) “UN 3480” for lithium ion cells or batteries;

c) “UN 3091” for lithium metal cells or batteries contained in, or packed with, equipment;

d) “UN 3481” for lithium ion cells or batteries contained in, or packed with, equipment; or

e) “UN 3552” for sodium ion cells or batteries contained in, or packed with, equipment.

32. Where a package contains lithium cells or batteries assigned to different UN numbers, all applicable UN numbers must be indicated on one or more marks.

33. The mark must be in the form of a rectangle or a square with hatched edging. The symbol (group of batteries, one damaged and emitting flame, above the UN number for lithium ion, lithium metal or sodium ion cells or batteries) must be black on white or suitable contrasting background. The hatching must be red. The mark must be a minimum dimension of 100 mm wide × 100 mm high and the minimum width of the hatching must be 5 mm. If the size of the package so requires, the dimensions may be reduced to not less than 100 mm wide × 70 mm high. Where dimensions are not specified, all features must be in approximate proportion to those shown on the full-size mark (Figure 5-3).

34. Packages containing lithium batteries that meet the requirements of Section IB of Packing Instructions 965 or 968 must bear both the battery mark (Figure 5-3) and the lithium battery or sodium ion battery Class 9 hazard label (Figure 5-26).

35. In addition to the languages which may be required by the State of Origin, English should be used.

Figure 5-3. Battery mark

Segment 5 Section 3

LABELLING

1. Where articles or substances are specifically listed in the Dangerous Goods List (Table 3-1), a danger class label must be affixed for the hazard shown in column 3 of Table 3-1. A subsidiary hazard label must also be affixed for any hazard indicated by a class or division number in column 4 of Table 3-1. However, special provisions indicated in column 7 may also require a subsidiary hazard label where no subsidiary hazard is indicated in column 4 or may exempt from the requirement for a subsidiary hazard label where such a hazard is indicated in the Dangerous Goods List.
2. Labels identifying the primary and subsidiary hazards of the dangerous goods must bear the class or division number.
3. All labels must be able to withstand open weather exposure without a substantial reduction in effectiveness.
4. The labels required to be displayed on packages of dangerous goods are identified in the Dangerous Goods List for articles and substances specifically listed by name and for articles and substances not specifically listed by name which are covered by generic or n.o.s. entries.
5. Packages containing substances of Class 8 need not show a subsidiary hazard label for Division 6.1 if the toxicity arises solely from the destructive effect on tissue. Substances of Division 4.2 need not show a subsidiary hazard label for Division 4.1 if the substance is also a flammable solid.
6. Packages containing organic peroxides which meet the criteria for Class 8, Packing Group I or II must be labelled with a corrosive subsidiary hazard label.
7. In addition to the primary hazard label (Figure 5-19), infectious substances packages must bear any other label required by the nature of the contents. This is not required if a quantity of 30 ml or less of dangerous goods included in classes 3, 8 or 9 is packed in each primary receptacle containing infectious substances.
8. Packages containing radioactive material having additional hazardous characteristics must also be labelled to indicate those characteristics.
9. Except when enlarged labels are used in accordance with 3.6, each package, overpack and freight container containing radioactive material must bear the labels conforming to Figures 5-20, 5-21 and 5-22 according to the appropriate category. Labels must be affixed to two opposite sides on the outside of the package or overpack or on the outside of all four sides of a freight container. Each overpack containing radioactive material must bear at least two labels on opposite sides of the outside of the overpack. In addition, each package, overpack and freight container containing fissile material, other than fissile material excepted under the provisions of 2;7.2.3.5 must bear labels conforming to the model shown in Figure 5-23; such labels, where applicable, must be affixed adjacent to the labels conforming to Figure 5-20, 5-21, or 5-22, as applicable. Labels must not cover the marks specified in Chapter 2. Any labels which do not relate to the contents must be removed or covered.
10. Intermediate bulk containers must comply with the labelling requirements applicable to other packagings, except that intermediate bulk containers of more than 450 L capacity must be labelled on two opposite sides.
11. Each class hazard label must:

    a) be affixed to a background of contrasting colour or must have a dotted or solid line outer boundary;

    b) be located on the same surface of the package near the proper shipping name mark, if the package dimensions are adequate;

    c) be so placed on the packaging that they are not covered or obscured by any part of or attachment to the packaging or any other label or mark;

    d) when primary and subsidiary hazard labels are required, be displayed next to each other; and

    e) be affixed at an angle of 45□ (diamond shaped), unless the package dimensions are inadequate.

12. Labels must not be folded. Cylindrical packages must be of such dimensions that a label will not overlap itself. In the case of cylindrical packages containing radioactive materials, which require two identical labels, these labels must be centred on opposite points of the circumference and must not overlap each other. If the dimensions of the package are such that two identical labels cannot be affixed without

overlapping each other, one label is acceptable provided it does not overlap itself.

13. Labels must be firmly affixed to or printed on the package of dangerous goods. Where a package is of such an irregular shape that a label cannot be affixed to or printed on a surface, it is acceptable to attach the label to the package by an adequately strong tag.

14. Since packages or consignments of magnetized material (Class 9) must bear the "Magnetized material" label (Figure 5-27) as required by column 5 of Table 3-1, such packages or consignments do not need to bear the "Miscellaneous dangerous goods" label (Figure 5-25).

15. In addition to the class hazard labels specified in 3.1, handling labels must also be affixed to packages of dangerous goods as follows:

    a) the "Cargo aircraft only" label (Figure 5-28) must be affixed:

        I. when the package containing the dangerous goods may only be transported on a cargo aircraft. However, where the packing instruction number and the permitted quantity per package are identical for passenger and cargo aircraft, the "Cargo aircraft only" label should not be used;

        II. to each Type B(M) package of radioactive material and any freight container containing such a Type B(M) package;

        III. on the same surface of the package near the hazard labels;

    b) when required by the provisions of 4;1.1.13, either the "Package orientation" label (Figure 5-29), or preprinted package orientation labels meeting the same specification as either Figure 5-29 or ISO Standard 780:1997, must be affixed to or printed on at least two opposite vertical sides of the package with the arrows pointing in the correct direction. The words "Dangerous goods" may be inserted on the label below the line;

    c) for packages containing refrigerated liquefied gases, the "Cryogenic liquid" label (Figure 5-31) must be affixed on all packages;

    d) for packages containing self-reactive substances of Division 4.1 or Division 5.2 organic peroxides, the "Keep away from heat" label (Figure 5-32) must be affixed on all packages. This label should be affixed on the same surface of the package near the hazard label(s);

    e) for excepted packages of radioactive material the "Radioactive material, excepted package" handling label (Figure 5-33) must be affixed;

    f) be affixed to a background of contrasting colour or must have a dashed or solid line outer boundary;

    g) be so placed on the packaging that they are not covered or obscured by any part of or attachment to the packaging or any other label or mark.

16. Where a text is indicated in Figures 5-1 to 5-33, an equivalent text in another language may be used.

17. Labels required by other international or national transport regulations are permitted in addition to labels required by these Instructions, provided that they cannot be confused with or conflict with any label prescribed by these Instructions, because of their colour, design or shape.

18. An overpack must be labelled as required for packages by Chapter 3, for each item of dangerous goods contained in the overpack unless labels representative of all dangerous goods in the overpack are visible.

19. An overpack containing liquid dangerous goods in single packagings with end closures must be labelled with either the "Package Orientation" label (Figure 5-29), or pre-printed package orientation labels meeting the same specification as either Figure 5-29 or ISO Standard 780:1997, unless such

labels are affixed to the package and are visible from the outside of the overpack. Such labels must be affixed to or printed on at least two opposite vertical sides of the overpack with the arrows pointing in the direction required to indicate the orientation of the overpack required to ensure that end closures are upward, notwithstanding that such single packages may also have side closures.

20. Arrows for purposes other than indicating proper package orientation must not be displayed on a package containing liquid dangerous goods.

21. Labels must satisfy the provisions of this section and conform, in terms of colour, symbols and general format, to the specimen labels shown in Figures 5-4 to 5-26.

22. Class hazard labels must conform to the following specifications:

    a) Labels must be configured as described below (see Figure 5-4).

        i) Labels must be displayed on a background of contrasting colour, or must have either a dotted or solid outer boundary line.

        ii) The label must be in the form of a square set at an angle of 45° (diamond shaped). The minimum dimensions must be 100 mm × 100 mm. There must be a line inside the edge forming the diamond which must be parallel and approximately 5 mm from the outside of that line to the edge of the label. The line inside the edge on the upper half of the label must be the same colour as the symbol, and the line inside the edge on the lower half of the label must be the same colour as the class or division number in the bottom corner. Where dimensions are not specified, all features must be in approximate proportion to those shown.

        iii) Labels of 50 mm × 50 mm may be used on packages containing infectious substances where the packages are of dimensions such that they can only bear smaller labels. Dimensions for labels on cylinders must comply with 3.5.1.1 b).

    b) Cylinders for Class 2 may, on account of their shape, orientation and securing mechanisms for transport, bear labels representative of those specified in this chapter, which have been reduced in size, according to ISO 7225:2005 “Gas cylinders – Precautionary labels”, for display on the non-cylindrical part (shoulder) of such cylinders. Labels may overlap to the extent provided for by ISO 7225:2005; however, in all cases the labels representing the primary hazard and the numbers appearing on any label must remain fully visible and the symbols recognizable.

    c) With the exception of labels for Divisions 1.4, 1.5 and 1.6 of Class 1, the upper half of the label must contain the pictorial symbol and the lower half must contain the class or, in the case of labels for Class 5, the division number, as appropriate. However for the Class 9 label for lithium batteries or sodium ion batteries (Figure 5-26), the upper half of the label must only contain the seven vertical stripes of the symbol and the lower half must contain the group of batteries of the symbol and the class number. Except for the Class 9 label for lithium batteries or sodium ion batteries (Figure 5-26), the label may include such text as the UN number, or words describing the hazard class (such as “flammable”) in accordance with 3.5.1.1 e) provided that the text does not obscure or detract from the other required label elements.

    d) In addition, except for Divisions 1.4, 1.5 and 1.6, labels for Class 1 must show in the lower half, above the class number, the division number and compatibility group letter for the substance or article. Labels for Divisions 1.4, 1.5 and 1.6 must show in the upper half the division number and in the lower half the class number and the compatibility group letter.

    e) On labels other than those for material of Class 7, the insertion of any text (other than the class or division number or compatibility group) in the space below the symbol

must be confined to particulars indicating the nature of the hazard and precautions to be taken in handling. In the case of the Class 9 label for lithium batteries or sodium ion batteries (Figure 5-26), no text other than the class number must be included in the bottom part of the label.

f) The symbols, texts and numbers must be shown in black on all labels except:

I. the Class 8 label, where the text (if any) and class number must appear in white;

II. labels with entirely green, red or blue backgrounds, where they may be shown in white;

III. the Division 5.2 label, where the symbol may be shown in white; and

IV. the Division 2.1 label displayed on cylinders and gas cartridges for liquefied petroleum gases, where they may be shown in the background colour of the receptacle if adequate contrast is provided.

g) A label may contain form identification information, including the name of its maker, provided that information is printed outside of the solid line border in no larger than 10-point type.

h) Each label conforming to the applicable Figure 5-20, 5-21 or 5-22 must be completed with the following information:

I. Contents:

i) except for LSA-I material, the name(s) of the radionuclide(s) as taken from Table 2-12, using the symbols prescribed therein. For mixtures of radionuclides, the most restrictive nuclides must be listed to the extent the space on the line permits. The group of LSA or SCO must be shown following the name(s) of the radionuclide(s). The terms “LSA-II”,“LSA-III”, “SCO-I” and “SCO-II” must be used for this purpose;

ii) for LSA-I material, the term “LSA-I” is all that is necessary; the name of the radionuclide is not necessary;

II. Activity: The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with the appropriate SI prefix symbol. For fissile material, the total mass of fissile nuclides in units of grams (g), or multiples thereof, may be used in place of activity;

III. For overpacks and freight containers the “contents” and “activity” entries on the label must bear the information required in 3.5.1.1 h) 1) A) and B), respectively, totalled together for the entire contents of the overpack or freight container except that on labels for overpacks or freight containers containing mixed loads of packages containing different radionuclides, such entries may read “See Transport Documents”;

IV. Transport index: The number determined in accordance with the requirements (except for category I-WHITE).

i) Each label conforming to Figure 5-23 must be completed with the criticality safety index (CSI) as stated in the certificate of approval applicable in the States through or into which the consignment is transported and issued by the competent authority.

j) For overpacks and freight containers, the label conforming to Figure 5-23 must bear the sum of the criticality safety indexes of all the packages contained therein.

k) In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different approval types apply in the different countries concerned by the shipment, the labelling must be in accordance with the certificate of the country of origin of design.

23. Illustrations of the class hazard labels, showing the approved symbols and colours, are given in Figures 5-5 to 5-26. The label descriptions used in column 5 of Table 3-1 are indicated in parentheses.

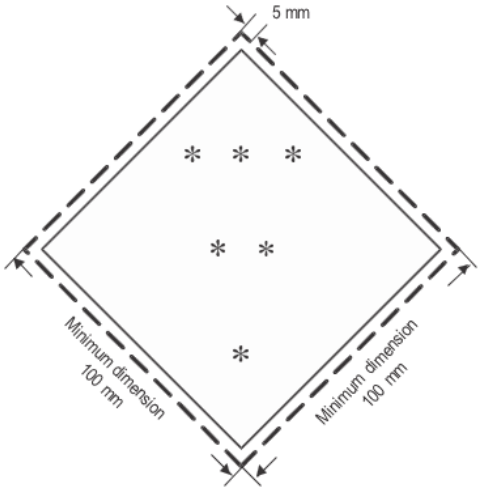
24. An illustration of each of the handling labels showing the approved design and colour is given in Figures 5-27 to 5-29 and Figures 5-31 to 5-33. The minimum label dimensions are shown in the figures. Where dimensions or features are not specified, these must be in approximate proportion to those shown; however:

    a) labels having dimensions not smaller than half of those indicated may be used on packages containing infectious substances when the packages are of dimensions such that they can only bear smaller labels; and

    b) orientation labels may meet the specification of either Figure 5-29 or ISO Standard 780:1997.

25. Large freight containers carrying packages (other than excepted packages) and tanks must bear four placards which conform with Figure 5-30. The placards must be affixed in a vertical orientation to each side wall and each end wall of the large freight container. Any placards which do not relate to the contents must be removed. Instead of using both labels and placards, it is permitted as an alternative to use enlarged labels only, as shown in Figures 5-20, 5-21 and 5-22, and where appropriate Figure 5-23, with dimensions as required for the placard in Figure 5-30.

26. For Class 7, the placard must have minimum overall dimensions of 250 mm by 250 mm with a black line running 5 mm inside the edge and parallel with it, and must be otherwise as shown in Figure 5-30. The number 7 must not be less than 25 mm high. The background colour of the upper half of the placard must be yellow and of the lower half white, the colour of the trefoil and the printing must be black. The use of the word “Radioactive” in the bottom half is optional to allow the use of this placard to display the appropriate United Nations number for the consignment.



* The class or, for Divisions 5.1 and 5.2, the division number must be shown in the bottom corner

** Additional text/numbers/symbol/letters must (if mandatory) or may (if optional) be shown in this bottom half

*** The class or division symbol or, for Divisions 1.4, 1.5 and 1.6, the division number and for Figure 5-23 the word “FISSILE” must be shown in this top half”.

Figure 5-4. Class/division label

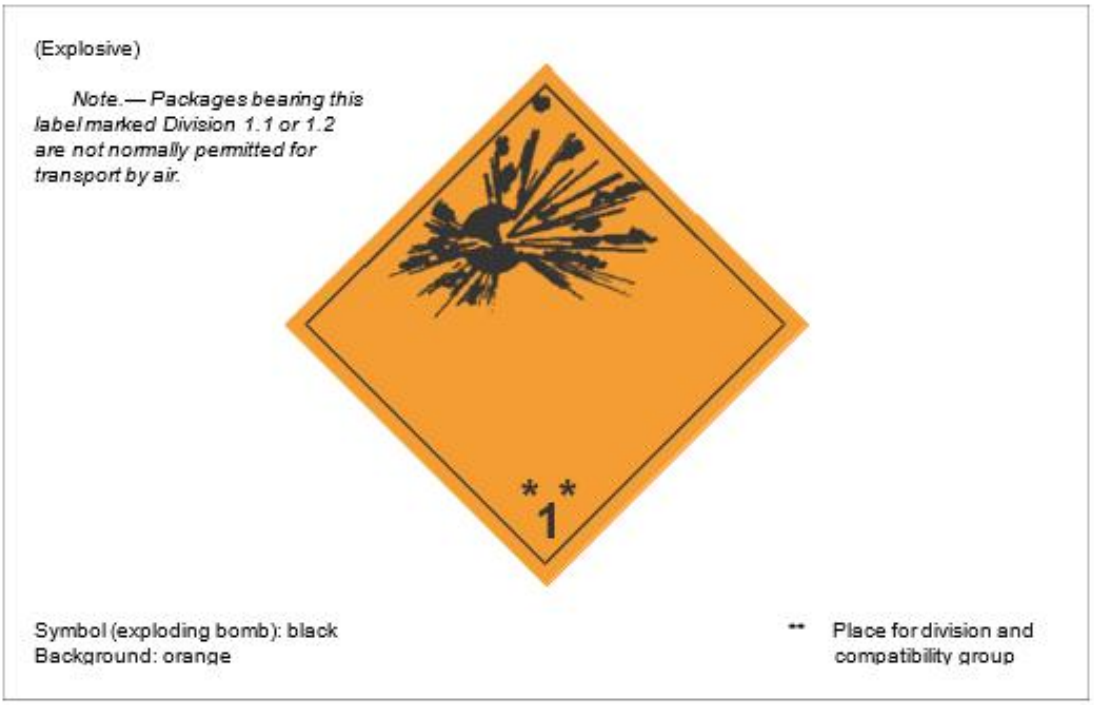


Figure 5-5. Explosive, Class 1, Divisions 1.1, 1.2 and 1.3

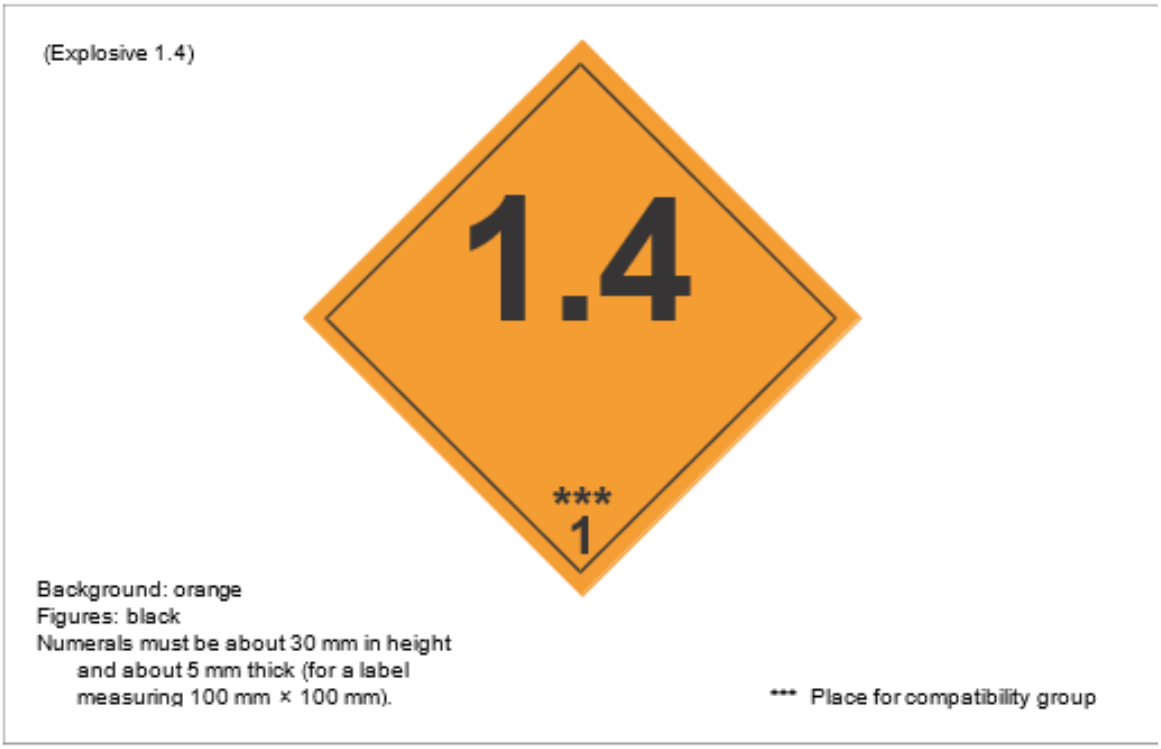


Figure 5-6. Explosive, Class 1, Division 1.4

Figure 5-7. Explosive, Class 1, Division 1.5

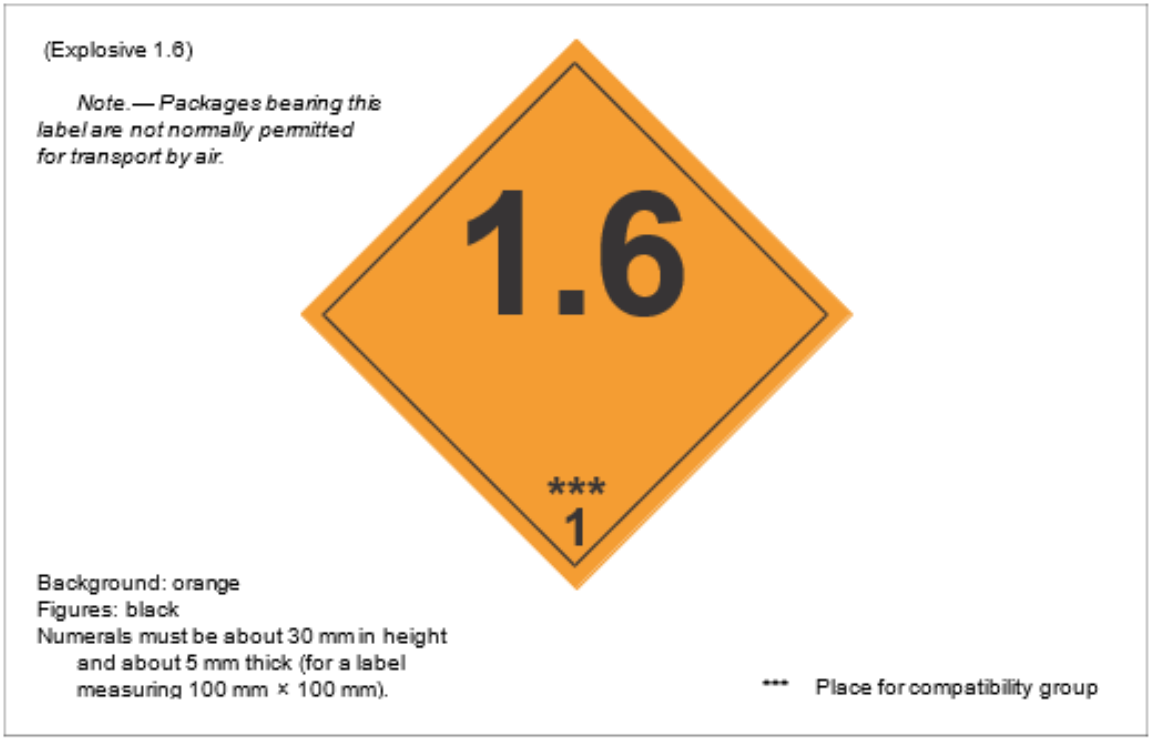


Figure 5-8. Explosive, Class 1, Division 1.6

Figure 5-9. Flammable gas, Class 2, Division 2.1

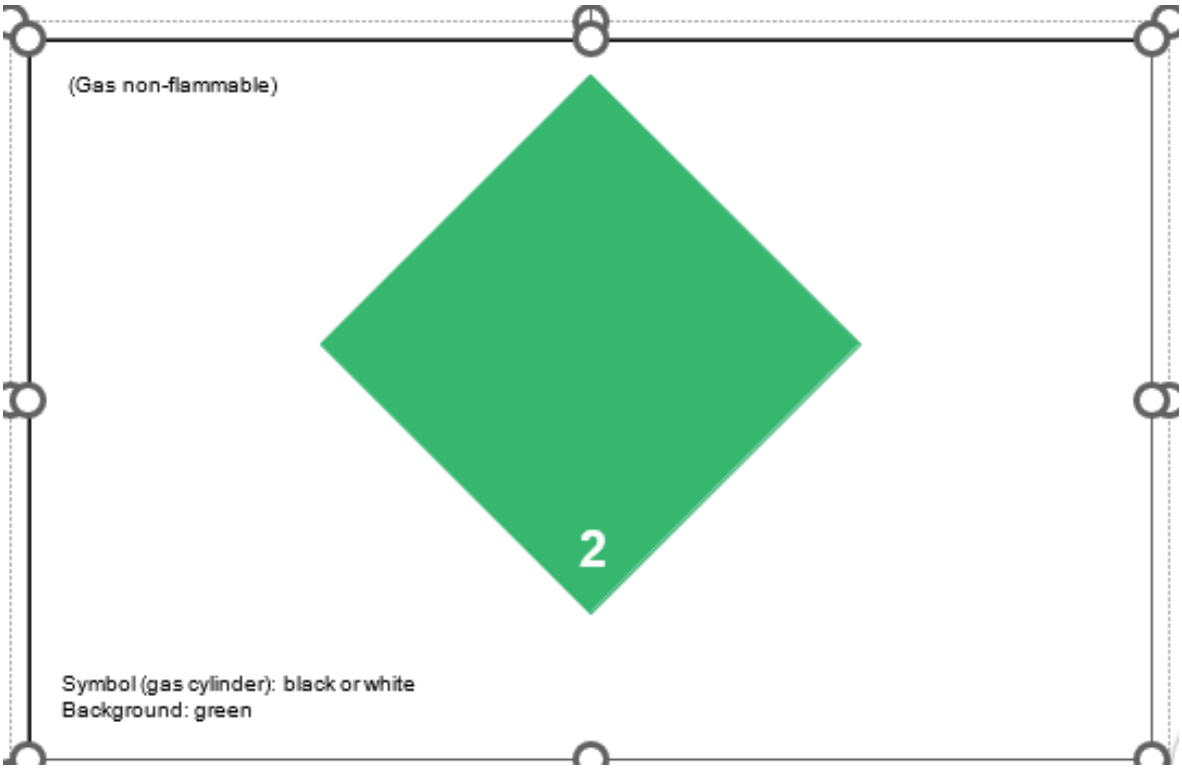


Figure 5-10. Non-flammable, non-toxic gas, Class 2, Division 2.2

(Gas toxic)

Symbol (skull and crossbones): black
Background: white

Figure 5-11. Toxic gas, Class 2, Division 2.3

Figure 5-12. Flammable liquid, Class 3

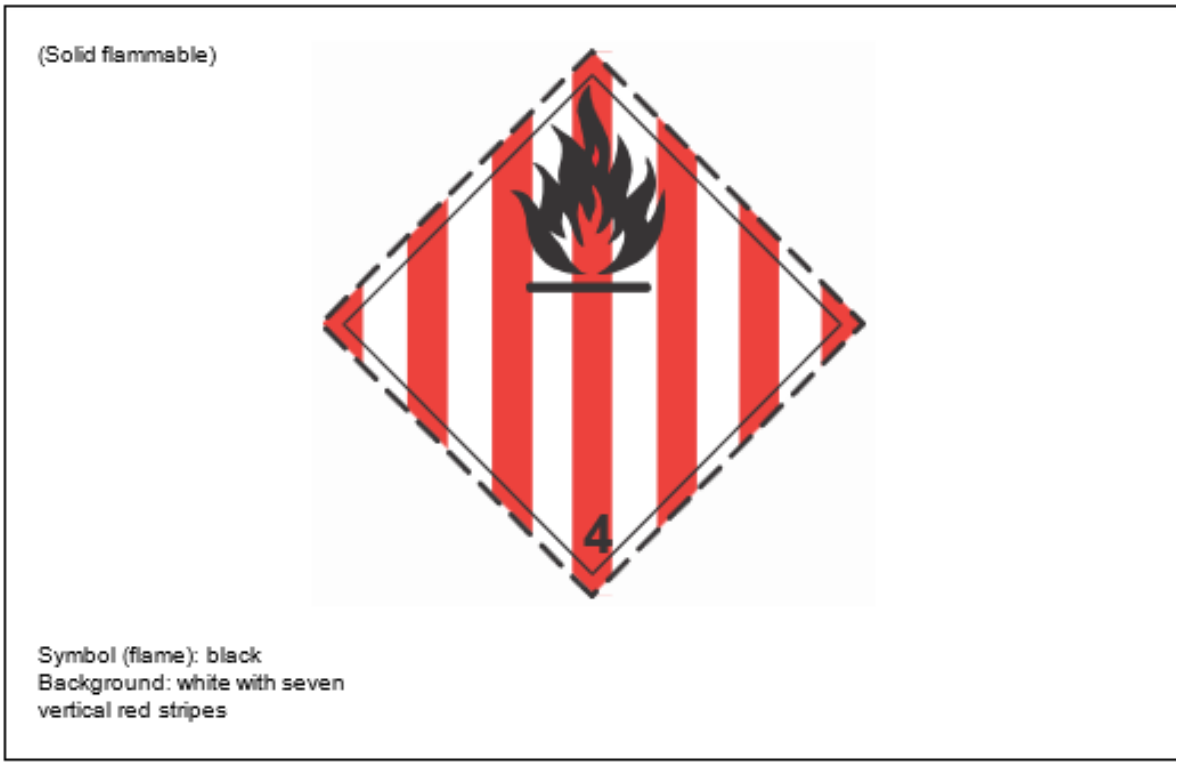


Figure 5-13. Flammable solid, Class 4, Division 4.1

(Spontaneous combustion)

Symbol (flame): black
Background: upper half white,
lower half red

Figure 5-14. Substance liable to spontaneous combustion, Class 4, Division 4.2

(Danger if wet)

Symbol (flame): black or white
Background: blue

Figure 5-15. Substance which, in contact with water, emits flammable gas, Class 4, Division 4.3

(Oxidizer)

Symbol (flame over circle): black
Background: yellow
Figure "5.1" in bottom corner

Figure 5-16. Oxidizing substance, Class 5

(Organic peroxide)

Symbol (flame): black or white
Background: upper half red; lower half yellow
Figure "5.2" in bottom corner

Figure 5-17. Organic peroxide, Class 5, Division 5.2

(Toxic)

Symbol (skull and crossbones): black
Background: white

Figure 5-18. Toxic substance, Class 6, Division 6.1

(Infectious)

The bottom part of the label should bear the inscription "INFECTIOUS SUBSTANCE – In case of damage or leakage immediately notify public health authority"

Symbol (three crescents superimposed on a circle) and inscription: black
Background: white
Figure "6" in bottom corner

Figure 5-19. Infectious substance, Class 6, Division 6.2

(Radioactive)

Radioactive material, Class 7, Category I – White
Symbol (trefoil): black
Background: white
Figure "7" in bottom corner

Text (mandatory), black in bottom half of label: "Radioactive"; "Contents . . ."; "Activity . . ."
One (1) red vertical stripe must follow the word "Radioactive".

Figure 5-20. Radioactive material, Class 7, Category I

(Radioactive)

Radioactive material, Class 7, Category II – Yellow
Symbol (trefoil): black
Background: top half yellow with white border, bottom half white
Figure "7" in bottom corner

Text (mandatory), black in bottom half of label: "Radioactive"; "Contents . . ."; "Activity . . ."; in a black outlined box – "Transport Index".
Two (2) red vertical stripes must follow the word "Radioactive".

Figure 5-21. Radioactive material, Class 7, Category II

(Radioactive)

Radioactive material, Class 7, Category III – Yellow
Symbol (trefoil): black
Background: top half yellow with white border, bottom half white
Figure "7" in bottom corner

Text (mandatory), black in bottom half of label: "Radioactive"; "Contents . . ."; "Activity . . ."; in a black outlined box – "Transport Index".
Three (3) red vertical stripes must follow the word "Radioactive".

Figure 5-22. Radioactive material, Class 7, Category III

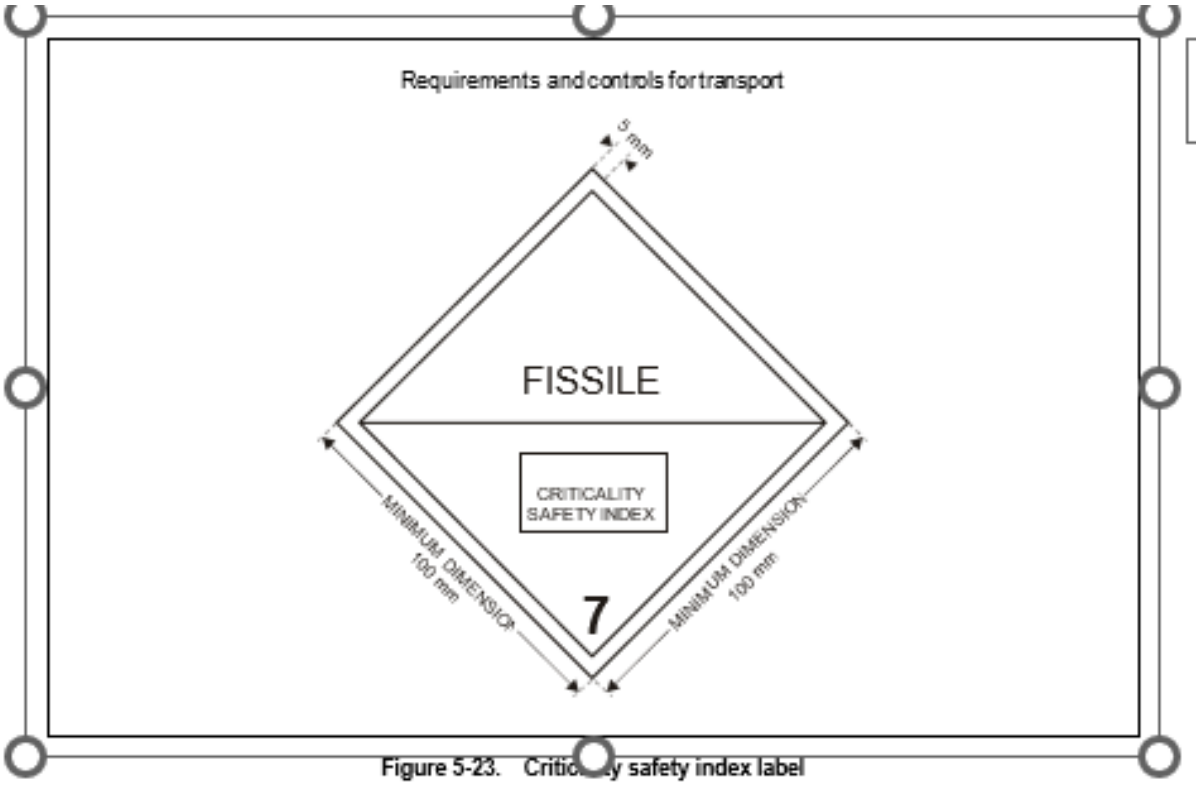


Figure 5-23. Criticality safety index label

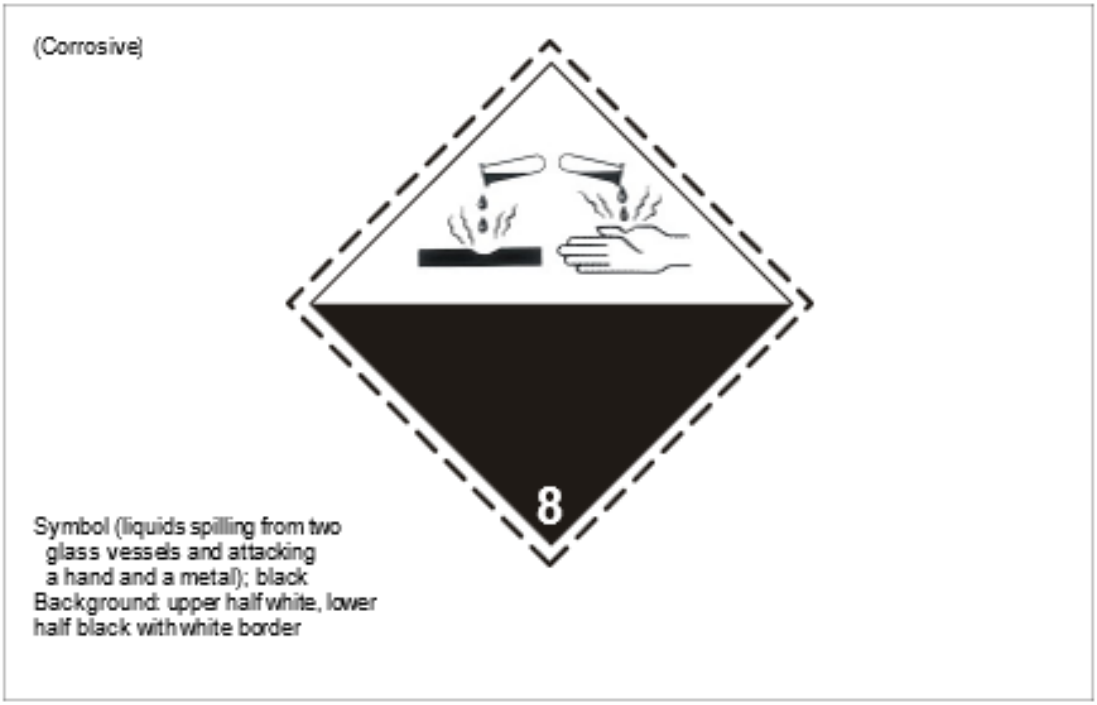


Figure 5-24. Corrosive, Class 8

(Miscellaneous)

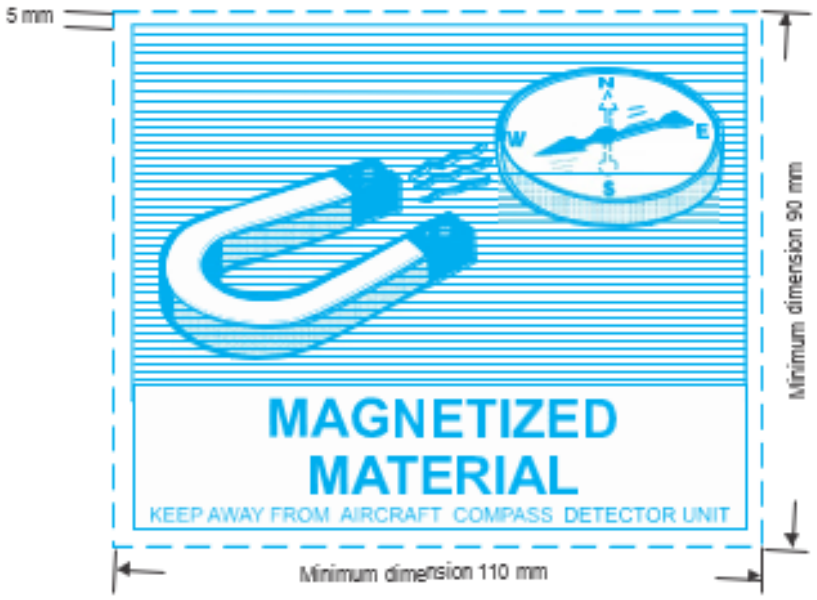
Symbol (seven vertical stripes in upper half): black
Background: white

Figure 5-25. Miscellaneous dangerous goods, Class 9

(Miscellaneous – Lithium cells and batteries or sodium ion cells and batteries)

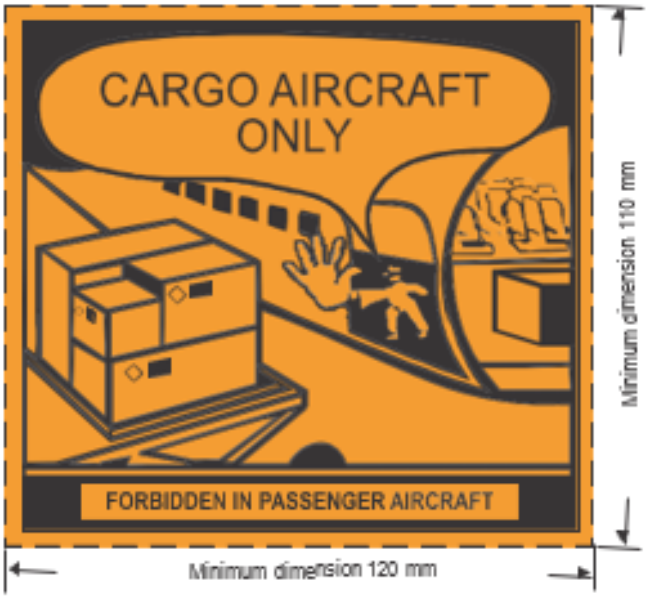
Symbol (seven vertical stripes in upper half); battery group, one broken and emitting flame in lower half: black
Background: white
Figure "9" underlined in bottom corner

Figure 5-26. Miscellaneous dangerous goods – lithium batteries or sodium ion batteries, Class 9



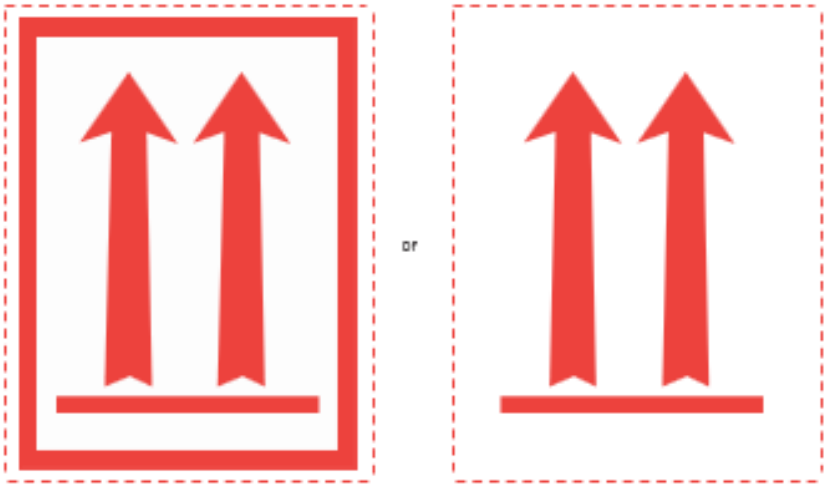
Colour: blue on white

Figure 5-27. Magnetized material



Colour: black on orange

Figure 5-28. Cargo aircraft only



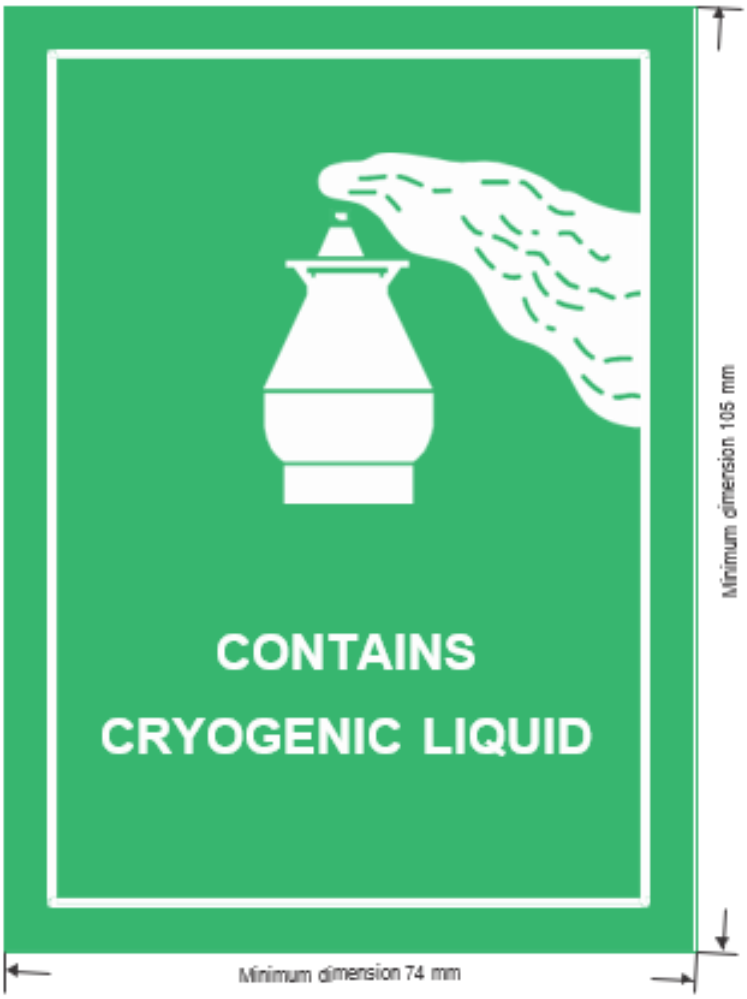
Two black or red arrows on white or suitable contrasting background
The rectangular border is optional
All features must be in approximate proportion to those shown
Dimensions: 74 mm × 105 mm

Figure 5-29. Package orientation

Radioactive material, Class 7
Placard
Symbol (trefoil): black
Background: top half yellow with white border, bottom half white
Dimensions: the minimum dimensions are shown. When larger dimensions are used, the relative proportions must be maintained. The figure "7" must be in the bottom corner and must be not less than 25 mm high.

Note.— The word "RADIOACTIVE" in the bottom half is optional to allow the alternative use of the appropriate UN number.

Figure 5-30. Radioactive material, Class 7, placard for large freight containers



Symbol: white
Background: green

Note.— The words "Caution – may cause cold burn injuries if spilled or leaked" are optional and may be included.

Figure 5-31. Cryogenic liquid label

Colour: red or black on a white background

Figure 5-32. Keep away from heat

Figure 5-33. Radioactive material, excepted package

Segment 5 Section 4

DOCUMENTATION

1. DANGEROUS GOODS TRANSPORT INFORMATION

a) The person who offers dangerous goods for transport by air must provide to the operator the information applicable to the consignment as set out in this paragraph. The information may be provided on a paper document or, where an agreement exists with the operator, by EDP or EDI techniques.

b) Where a paper document is used, the person who offers dangerous goods for transport by air must provide to the operator two copies of the dangerous goods transport document, completed and signed as provided for in this paragraph.

c) Where the dangerous goods transport information is provided by EDP or EDI techniques the data must be able to be produced as a paper document without delay, with the data in the sequence required by this chapter.

2. Form of the transport document

a) A dangerous goods transport document may be in any form, provided it contains all of the information required by these Instructions.

b) If both dangerous and non-dangerous goods are listed in one document, the dangerous goods must be listed first, or otherwise be emphasized.

3. *Continuation page*

   a) A dangerous goods transport document may consist of more than one page, provided pages are consecutively numbered.

   b) The information on a dangerous goods transport document must be easy to identify, legible and durable.

   c) Shipper and consignee

4. The name and address of the shipper and the consignee of the dangerous goods must be included on the dangerous goods transport document. For the transport of radioactive material, it is recommended that the telephone number of the consignee is included to facilitate a prompt release at the airport of destination.

5. Information required on the dangerous goods transport document

   The dangerous goods transport document must contain the following information for each dangerous substance, material or article offered for transport:

   a) the UN or ID number preceded by the letters “UN” or “ID” as appropriate;

   b) the proper shipping name, as determined according to Segment 3;1.2, including the technical name enclosed in parenthesis, as applicable;

   c) the primary hazard class or, when assigned, the division of the goods, including for Class 1 the compatibility group letter. The words “Class” or “Division” may be included preceding the primary hazard class or division numbers;

   d) subsidiary hazard class or division number(s) corresponding to the subsidiary hazard label(s) required to be applied, when assigned, must be entered following the primary hazard class or division and must be enclosed in parenthesis. The words “Class” or “Division” may be included preceding the subsidiary hazard class or division numbers;

   e) where assigned, the packing group for the substance or article which may be preceded by “PG” (such as “PG II”).

6. Sequence of the dangerous goods description

   The five elements of dangerous goods description specified must be shown in the order listed above (that is, a), b), c), d), e)), with no information interspersed, except as provided in these Instructions. Examples of a dangerous goods description are:

   “UN 1717 Acetyl chloride 3 (8) II” or
   “UN 1717 Acetyl chloride, Class 3 (Class 8), PG II”

   a) Information which supplements the proper shipping name in the dangerous goods description

   The proper shipping name in the dangerous goods description must be supplemented as follows:

   i) *Technical names for “n.o.s.” and other generic descriptions*: Proper shipping names that are assigned an asterisk in column 1 of the Dangerous Goods List must be supplemented with their technical or chemical group names as described in Segment 3;1;

ii) *Empty uncleaned packagings*: Empty means of containment which contain the residue of dangerous goods of classes other than Class 7 must be described as such by, for example, placing the words “Empty uncleaned” or “Residue last contained” before or after the dangerous goods description specified;

iii) *Wastes*: For waste dangerous goods (other than radioactive wastes) which are being transported for disposal, or for processing for disposal, the proper shipping name must be preceded by the word “Waste”, unless this is already a part of the proper shipping name;

iv) *Molten substances:* When a substance, which is solid in accordance with the definition in Segment 1;3, is offered for transport in the molten state, the qualifying word “Molten” must be added as part of the proper shipping name, unless it is already part of the proper shipping name;

v) *Stabilized substances:* Unless already part of the proper shipping name, the word “Stabilized” must be added to the proper shipping name if stabilization is used.

b) Information required in addition to the dangerous goods description

In addition to the dangerous goods description the following information must be included after the dangerous goods description on the dangerous goods transport document.

7. Quantity of dangerous goods, number and type of packagings

The number of packages, type of packaging (such as steel drum, fibreboard box, etc.) and net quantity of dangerous goods in each package (by volume or mass, as appropriate) must be indicated for each item of dangerous goods bearing a different proper shipping name, UN number or packing group. Abbreviations may be used to specify the unit of measurement for the quantity.

For packages containing the same dangerous goods and quantity per package a multiple of the quantity may be used. For example:

UN 1263, Paint, 3, PG II, 5 fibreboard boxes x 5 L

Consignment comprising packages of different quantities of the same dangerous good must be clearly identified. For example: UN 1263, Paint, 3, PG II, 5 fibreboard boxes x 5 L, 10 fibreboard boxes x 10 L

UN packaging codes may only be used to supplement the description of the kind of package (such as one fibreboard box (4G)). For limited quantities, where the letter “G” follows the quantity in column 11 of Table 3-1, the gross mass of each package must be indicated, rather than the net quantity (except when there are different dangerous goods packed together in the same outer packaging which must be described as shown in paragraph e)) and:

a) for empty uncleaned packagings only the number and type of packagings need be shown;

b) for chemical kits and first aid kits, the total net mass of dangerous goods. Where the kits contain solids and/or liquids, the net mass of liquids within the kits is to be calculated on a 1 to 1 basis of their volume, that is, 1 L equal to 1 kg;

c) for dangerous goods in machinery or apparatus, the individual total quantities of dangerous

goods in solid, liquid or gaseous state, contained in the article;

d) for dangerous goods transported in salvage packagings, an estimate of the quantity of dangerous goods must be given;

e) for dangerous goods in limited quantities with a 30 kg G limit in Table 3-1, where different dangerous goods are packed together in the same outer packaging, the net quantity of each dangerous goods followed by the gross mass of the completed package;

f) for explosive articles of Class 1, the net quantity indicated for each package must be supplemented with the net explosive mass contained in the package followed by the unit of measurement. The abbreviations "NEQ", "NEM" or "NEW" may be indicated in association with the value provided.

8. Salvage packagings

For dangerous goods transported in salvage packagings, the words "Salvage packaging" must be included.

a) *Chemical oxygen generators*

When chemical oxygen generators contained in protective breathing equipment (PBE) are being transported under Special Provision A144, the statement "Aircrew protective breathing equipment (smoke hood) in accordance with Special Provision A144" must be included on the dangerous goods transport document.

b) *Self-reactive substances and organic peroxides*

i) When organic peroxides and self-reactive substances are transported under conditions where approval is required, a statement to this effect must be included in the dangerous goods transport document. A copy of the classification approval and conditions of transport for non-listed organic peroxides and self-reactive substances must be attached to the dangerous goods transport document.

ii) When a sample of an organic peroxide or a self-reactive substance is transported, a statement to this effect must be included in the dangerous goods transport document.

c) Infectious substances and controlled substances

The dangerous goods transport document must also include the name and telephone number of a responsible person when a national law or international convention prohibits the disclosure of the technical name following an "n.o.s.*" entry or for infectious substances, UN 2814 and UN 2900.

d) Firework classification reference

e) When fireworks of UN 0336 or UN 0337 are transported, the dangerous goods transport document must include a classification reference(s) issued by the appropriate national authority.

f) The classification reference(s) must consist of the appropriate national authority's State, indicated by the distinguishing sign used on vehicles in international traffic, the appropriate national authority identification and a unique serial reference. Examples of such classification references are:

9. *Radioactive material*

The following information must be included for each consignment of Class 7 material, as applicable, in the order given:

a) The name or symbol of each radionuclide or, for mixtures of radionuclides, an appropriate general description or a list of the most restrictive nuclides;

b) A description of the physical and chemical form of the material, or a notation that the material is special form radioactive material or low dispersible radioactive material. A generic chemical description is acceptable for chemical form;

c) The maximum activity of the radioactive contents during transport expressed in units of becquerels (Bq) with an appropriate SI prefix symbol. For fissile material, the mass of fissile material (or mass of each fissile nuclide for mixtures when appropriate) in units of grams (g), or appropriate multiples thereof, may be used in place of activity;

d) The category of the package and if applicable for the overpack and freight container, as assigned per 1.2.3.1.4, that is, I-WHITE, II-YELLOW, III-YELLOW;

e) The transport index as determined (except for category I-WHITE);

+ f) For Category II-Yellow and III-Yellow only: the dimensions including dimensional units of each package, or when placed in an overpack or freight container, the dimensions of the overpack, or the freight container, as applicable. The dimensions should be shown in the following order: length x width (or diameter, if applicable) x height. "L", "W" (or "D"), "H" may be shown immediately preceding their respective dimension. When a different order is used, the letters "L", "W" (or "D") and "H" must be shown accordingly;

g) For fissile material:

I. shipped under one exception, reference to that paragraph;

II. shipped under Segment 2; the total mass of fissile nuclides;

III. contained in a package for which one of Segment 6;7 is applied, reference to that paragraph; and

IV. the criticality safety index, where applicable.

h) The identification mark for each competent authority certificate of approval applicable to the consignment;

i) For consignments of more than one package, the required information must be given for each package. For packages in an overpack or freight container, a detailed statement of the contents of each package within the overpack or freight container and, where appropriate, of each overpack or freight container must be included. If packages are to be removed from the overpack or freight container at a point of intermediate unloading, appropriate transport documents must be made available;

ii) Where a consignment is required to be shipped under exclusive use, the statement "EXCLUSIVE USE SHIPMENT"; and

iii) For LSA-II, LSA-III, SCO-I and SCO-II, the total activity of the consignment as a multiple of A_2. For radioactive material for which the A_2 value is unlimited, the multiple of A_2 must be zero.

10. The shipper must provide a statement regarding actions, if any, that are required to be taken by the carrier. The statement must be in the languages deemed necessary by the carrier or the authorities concerned, and must include at least the following points:

a) Supplementary requirements for loading, stowage, carriage, handling and unloading of the package, overpack or freight container including any special stowage provisions for the safe dissipation of heat or a statement that no such requirements are necessary;

b) Restrictions on the type of aircraft and any necessary routeing instructions;

c) Emergency arrangements appropriate to the consignment.In all cases of international transport of packages requiring competent authority approval of design or shipment, for which different

approval types apply in the different countries concerned by the shipment, the UN number and proper shipping name must be in accordance with the certificate of the country of origin of design.

11. The applicable competent authority certificates need not necessarily accompany the consignment. The shipper must make them available.

12. *Additional requirements*

    a) The dangerous goods transport document must also contain:

    I. except for radioactive material, the packing instruction applied. For shipments of lithium batteries prepared in accordance with Section IB of Packing Instruction 965 or Packing Instruction 968, the letters "IB" must be added following the packing instruction number;

    II. when applicable, reference to Special Provision A1, A2, A4, A5, A51, A88, A99, A176, A190, A191, A201, A202, A211, A212, A224 or A225;

    III. a statement indicating that the shipment is within the limitations prescribed for either passenger and cargo aircraft or cargo-only aircraft, as appropriate;

    IV. special handling information, when appropriate;

    V. an indication that an overpack has been used, when appropriate;

    VI. the "Q" value rounded up to the first decimal place, where applicable; and

    VII. for individual radionuclides or for mixtures of radionuclides for which relevant data are not available or which are not listed in Table 2-12 and where Table 2-13 was used to determine the maximum allowed activity, the use of Table 2-13 must be referenced as well as the radioactive contents as specified in the first column of Table 2-13. For example: "Table 2-13 used. Only beta- or gamma-emitting nuclides are known to be present".

13. For explosive substances, where Packing Instruction 101 has been adopted by an appropriate national authority, the State's distinguishing sign for motor vehicles in international traffic of the country for which the authority acts must be marked on the dangerous goods transport document as follows:

14. When self-reactive substances of Division 4.1, or organic peroxides of Division 5.2 or other substances having similar properties, are offered for transport, the shipper must indicate on the dangerous goods transport document that the packages containing such substances must be protected from direct sunlight and all sources of heat and be placed in adequately-ventilated areas.

    a) Classification where new data is available (refer to Technical Standards)

    For transport in accordance with 2;0.1, a statement to this effect must be included on the dangerous goods transport document.

    b) Application of special provisions

    Where, in accordance with a special provision in Table 3-2, additional information is necessary, this additional information must be included on the dangerous goods transport document.

15. Certification

    a) The dangerous goods transport document must include a certification or declaration that the consignment is acceptable for transport and that the goods are properly packaged, marked and labelled, and in proper condition for transport in accordance with the applicable regulations and including additional air transport requirements of these Instructions.

16. The text for this certification is:

    "I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and

labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations."

For air transport the following additional statement is required:

"I declare that all of the applicable air transport requirements have been met."

The certification must be signed and dated by the shipper. Facsimile signatures are acceptable where applicable laws and regulations recognize the legal validity of facsimile signatures.

a) If the dangerous goods documentation is presented to the operator by means of EDP or EDI transmission techniques, the signature(s) may be electronic signature(s) or may be replaced by the name(s) (in capitals) of the person authorized to sign. Where the original consignment details are provided to an operator, by EDP or EDI techniques, and subsequently the consignment is transhipped to an operator that requires a paper dangerous goods transport document, the operator must ensure the paper document indicates "Original Received Electronically" and the name of the signatory must be shown in capital letters.

b) In addition to the languages which may be required by the State of Origin, English should be used for the dangerous goods transport document.

17. AIR WAYBILL

When an air waybill is issued for a consignment for which a dangerous goods transport document is required, the air waybill must contain a statement to indicate that the dangerous goods are described on an accompanying dangerous goods transport document. An air waybill issued for a consignment must, when applicable, indicate that the consignment must be loaded on cargo aircraft only.

18. ADDITIONAL DOCUMENTATION FOR OTHER THAN RADIOACTIVE MATERIAL

a) When dangerous goods are shipped as authorized by Special Provision A1 or A2, they must be accompanied by a copy of the document(s) of approval, showing the quantity limitations, the packing requirements and, in the case of A2, the labelling requirements.

b) When dangerous goods are shipped in portable tanks as authorized, they must be accompanied by a copy of the document(s) of approval.

c) When dangerous goods are shipped in packagings as authorized, they must be accompanied by a copy of the document(s) of approval.

d) When organic peroxides and self-reactive substances require an approval prior to transport, a copy of the approval must be attached to the dangerous goods transport document.

e) When dangerous goods are shipped under exemption, a copy of the exemption must accompany the consignment. Where more than one State has granted an exemption for a particular consignment, the documents that need to accompany it are the exemptions granted by the States of Origin, Transit (if relevant) and Destination.

19. RETENTION OF DANGEROUS GOODS TRANSPORT INFORMATION

a) The shipper must retain a copy of the dangerous goods transport document and additional information and documentation as specified in these Instructions, for a minimum period of three months and be made available to the appropriate national authority upon request.

b) When the documents are kept electronically or in a computer system, the shipper must be able to reproduce them in a printed form.

Segment 6

1) APPLICABILITY

a) The requirements for packagings in Section 3 are based on packagings currently used. In order to take into account progress in science and technology, there is no objection to the use of packagings having specifications different from those in Chapter 3, provided they are equally effective, acceptable to the appropriate authority and able to successfully fulfil the requirements described in section 4 and Chapter 4. Methods of testing other than those described in these standards are acceptable, provided they are equivalent.

b) Packagings must be manufactured and tested under a quality assurance programme that satisfies the appropriate national authority.

c) Manufacturers and subsequent distributors of packagings must provide information regarding procedures to be followed (including closure standards for inner packagings and receptacles), a description of the types and dimensions of the closures (including required gaskets) and any other components needed to ensure that packages, as presented for transport, are capable of passing the applicable performance tests and the pressure differential requirements.

2) CODES FOR DESIGNATING TYPES OF PACKAGINGS

a) The code consists of:
   - an Arabic numeral indicating the kind of packaging, such as drum, jerrican, etc., followed by
   - a capital letter(s) in Latin characters indicating the nature of the material, such as steel, wood, etc., followed where necessary by

— an Arabic numeral indicating the category of packaging within the kind to which the packaging belongs.

b) In the case of composite packagings, two capital letters in Latin characters are used in sequence in the second position of the code. The first indicates the material of the inner receptacle and the second that of the outer packaging.

c) For combination packagings, only the code number for the outer packaging is used.

d) The following numerals must be used for the kinds of packaging:

1. Drum
2. Reserved
3. Jerrican
4. Box
5. Bag
6. Composite packaging.

e) The following capital letters must be used for the types of material:

A. Steel (all types and surface treatments)
B. Aluminium
C. Natural wood
D. Plywood
F. Reconstituted wood
G. Fibreboard
H. Plastic material
L. Textile
M. Paper, multiwall
N. Metal (other than steel or aluminium)
P. Glass, porcelain or stoneware (not used in these standards).

3) INDEX OF PACKAGINGS

Table below contains an index of packagings, other than inner packagings.

Table 6-2. Index of packagings other than inner packagings

Kind	*Code and, where applicable, category*		*Maximum capacity (L)*	*Maximum net mass (kg)*
Steel drums	1A1	non-removable head	450	400
	1A2	removable head	450	400
Aluminium drums	1B1	non-removable head	450	400
	1B2	removable head	450	400
Metal (other than steel or aluminium) drums	1N1	non-removable head removable head	450	400
	1N2		450	400
Steel jerricans	3A1	non-removable head	60	120
	3A2	removable head	60	120
Aluminium jerricans	3B1	non-removable head	60	120
	3B2	removable head	60	120
Plywood drums	1D		250	400

Reserved					
Fibre drums	1G			450	400
Plastic drums and jerricans	1H1	drums, non-removable head		450	400
	1H2	drums, removable head		450	400
	3H1	jerricans, non-removable head		60	120
	3H2	jerricans, removable head		60	120
Boxes of natural wood	4C1	ordinary			
	4C2	with siftproof walls			
Plywood boxes	4D				
Reconstituted wood boxes	4F				
Fibreboard boxes	4G				
Plastic boxes	4H1	expanded plastic boxes			
	4H2	solid plastic boxes			
Steel, aluminium or other metal boxes	4A	steel			
	4B	aluminium			
	4N	metal, other than steel or aluminium			
Textile bags	5L1	without inner liner or coating	Not used in these standards		
	5L2	siftproof			
	5L3	water-resistant			
Woven plastic bags	5H1	without inner liner or coating		Specialized use only	
	5H2	siftproof			
	5H3	water-resistant			
Plastic film bags	5H4				
Paper bags	5M1	multiwall			
	5M2	multiwall, water-resistant			
Composite packaging	6HA1	plastic receptacle with outer steel drum		250	
(plastic material)	6HA2	plastic receptacle with outer steel crate*/or box		60	
	6HB1	plastic receptacle with outer aluminium drum		250	
	6HB2	plastic receptacle with outer aluminium crate*/or box		60	
	6HC	plastic receptacle with outer wooden box		60	
	6HD1	plastic receptacle with outer plywood drum		250	
	6HD2	plastic receptacle with outer plywood box		60	
	6HG1	plastic receptacle with outer fibre drum		250	
	6HG2	plastic receptacle with outer fibreboard box		60	
	6HH1	plastic receptacle with outer plastic drum		250	
	6HH2	plastic receptacle with outer solid plastic box		60	
Composite packagings (glass,	6PA1	receptacle with outer steel drum			
porcelain or stoneware)	6PA2	receptacle with outer steel crate*/or box			
	6PB1	receptacle with outer aluminium drum			
	6PB2	receptacle with outer aluminium crate*/or box			
	6PC	receptacle with outer wooden box			
	6PD1	receptacle with outer plywood drum	Not used in these standards		
	6PD2	receptacle with outer wickerwork hamper			
	6PG1	receptacle with outer fibre drum			
	6PG2	receptacle with outer fibreboard box			
	6PH1	receptacle with outer expanded plastic packaging			
	6PH2	receptacle with outer solid plastic packaging			

1. MARKING OF PACKAGINGS OTHER THAN INNER PACKAGINGS

1) MARKING REQUIREMENTS FOR PACKAGINGS OTHER THAN INNER PACKAGINGS

a) Each packaging intended for use according to these standards must bear marks on a non-removable component which are durable, legible and placed in a location and of such a size relative to the packaging as to be readily visible. For packages with a gross mass of more than 30 kg the marks, or a duplicate thereof, must appear on the top or on a side of the packaging. Letters, numerals and symbols must be at least 12 mm high, except for packagings of 30 L capacity or less or of 30 kg maximum net mass, when they must be at least 6 mm in height and except for packagings of 5 L capacity or less or of 5 kg maximum net mass when they must be of an appropriate size.

The marks must show:

i) the United Nations packaging symbol

This symbol must not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Segment 6. For embossed metal packagings the capital letters “UN” may be applied as the symbol;

ii) the code designating the type of packaging;

iii) a code in two parts:

b) a letter designating the packing group(s) for which the design type has been successfully tested:

X for Packing Groups I, II and III

Y for Packing Groups II and III

Z for Packing Group III only;

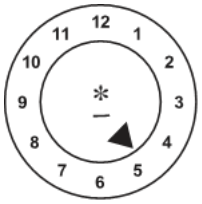
i) for single packagings intended to contain liquids: the relative density, rounded off to the first decimal, for which the design type has been tested; this may be omitted when the relative density does not exceed 1.2;

ii) for packagings intended to contain solids or inner packagings: the maximum gross mass, in kilograms, at which the design type has been tested;

iii)

- for single packagings intended to contain liquids: the hydraulic test pressure which the packaging was shown to withstand, in kPa rounded down to the nearest 10 kPa;
- for packagings intended to contain solids or inner packagings: the letter “S”;

iv) the last two digits of the year during which the packaging was manufactured. Packagings of types 1H1, 1H2, 3H1 and 3H2 must also be appropriately marked with the month of manufacture; this may be marked on the packaging in a different place from the remainder of the mark. An appropriate method is:



The last two digits of the year of manufacture may be displayed at that place. In such a case, and when the clock is placed adjacent to the UN design type mark, the indication of the year in the mark may be waived. However, when the clock is not placed adjacent to the UN design type mark, the two digits of the year in the mark and in the clock must be identical.

v) the State authorizing the allocation of the mark, indicated by the distinguishing sign used on vehicles in international road traffic;

vi) the name of the manufacturer or other identification of the packaging specified by the appropriate national authority.

c) In addition to the durable marks prescribed in b), every new metal drum of a capacity greater than 100 L must bear the marks described in b) i) to e) on the bottom, with an indication of the nominal thickness of at least the metal used in the body (in mm, to 0.1 mm), in a permanent form (such as embossed). When the nominal thickness of either head of a metal drum is thinner than that of the body, the nominal thicknesses of the top head, body and bottom head must be marked on the bottom in a permanent form (such as embossed).
d) Every packaging liable to undergo a reconditioning process other than those referred to in c) must bear the marks indicated in b i) to v) in a permanent form. Marks are permanent if they are able to withstand the reconditioning process (such as embossed). For packagings other than metal drums of a capacity greater than 100 L, these permanent marks may replace the corresponding durable marks prescribed in b).
e) For re-manufactured metal drums, if there is no change to the packaging type and no replacement or removal of integral structural components, the required marks need not be permanent (such as embossed). Every other re-manufactured metal drum must bear the marks indicated in b i) to v)in a permanent form (such as embossed) on the top head or side.
f) Metal drums made from materials (such as stainless steel) designed to be reused repeatedly may bear the marks indicated in b) in a permanent form (such as embossed).
g) After reconditioning a packaging, the reconditioner must apply to it, in sequence, durable marks showing:

    l) the State in which the reconditioning was carried out, indicated by the distinguishing sign used on vehicles in international road traffic;

Note.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

II) the name of the reconditioner or other identification of the packaging specified by the appropriate national authority;

III) the year of reconditioning; the letter “R”; and for every packaging successfully passing the leak proofness test, the additional letter “L”.

h) When, after reconditioning, the marks required by b i) to iv) no longer appear on the top head or the side of a metal drum, the reconditioner must apply them in a durable form followed by those required by f). These marks must not identify a greater performance capability than that for which the original design type had been tested and marked.

i) Examples for marking NEW packagings:

for a new fibreboard box
4G/Y145/S/02
NL/VL823

for a new steel drum to contain liquids
1A1/Y1.4/150/98
NL/VL824

for a new steel drum to contain solids, or inner packagings
1A2/Y150/S/01
NL/VL825

for a new plastic box of equivalent specification
4HW/Y136/S/98
NL/VL826

for a remanufactured steel drum to contain liquids
1A2/Y/100/01
USA/MM5

j) Where a packaging conforms to more than one tested packaging design type, the packaging may bear more than one mark to indicate the relevant performance test requirements that have been met. The marks must appear in close proximity to one another and each mark must appear in its entirety.

2. REQUIREMENTS FOR PACKAGINGS

1) REQUIREMENTS FOR PACKAGINGS OTHER THAN INNER PACKAGINGS

GENERAL REQUIREMENTS

Any permeation of the substance contained in the packaging must not constitute a danger under normal conditions of transport.

a) Steel drums

1A1 non-removable head 1A2 removable head

i) Body and heads must be constructed of steel sheet of a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use

ii) Body seams must be welded on drums intended to contain more than 40 L of liquids. Body seams must be mechanically seamed or welded on drums intended to contain solids, or 40 L or less of liquids.

iii) Chimes must be mechanically seamed or welded. Separate reinforcing rings may be applied.

iv) Drums may have rolling hoops, either expanded or separate. If there are separate rolling hoops they must be fitted tightly on the body and so secured that they cannot shift. Rolling hoops must not be spot welded.

v) Openings for filling, emptying and venting in the bodies or heads of non-removable head (1A1) drums must not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable head type (1A2). Closures for openings in the bodies and heads of drums must be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges may be mechanically seamed or welded in place. Gaskets or other sealing elements must be used with closures, unless the closure is inherently leakproof.

vi) Closure devices for removable head drums must be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with all removable heads.

vii) If materials used for body, heads, closures and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments must be applied. These coatings or treatments must retain their protective properties under normal conditions of transport.

viii) Maximum capacity of drum: 450 L.

ix) Maximum net mass: 400 kg.

b) Aluminium drums

1B1 non-removable head 1B2 removable head

i) Body and heads must be constructed of aluminium at least 99 per cent pure or of an aluminium base alloy. Materials must be of a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use.

ii) All seams must be welded. Chime seams, if any, must be reinforced by the application of separate reinforcing rings.

iii) Drums may have rolling hoops, either expanded or separate. If there are separate rolling hoops they must be fitted tightly on the body and so secured that they cannot shift. Rolling hoops must not be spot welded.

iv) Openings for filling, emptying and venting in the bodies or heads on non-removable head (1B1) drums must not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable head type (1B2). Closures for openings in the bodies and heads of drums must be so designed and applied that they will remain secure and leakproof under normal conditions of transport.

Closure flanges must be welded in place so that the weld provides a leakproof seam. Gaskets or other sealing elements must be used with closures, unless the closure is inherently leakproof.

v) Closure devices for removable head drums must be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with all removable heads.

vi) If materials used for body, heads, closures and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments must be applied. These coatings or treatments must retain their protective properties under normal conditions of transport.

vii) Maximum capacity of drum: 450 L.

viii) Maximum net mass: 400 kg.

c) Drums of metal other than aluminium or steel
1N1 non-removable head 1N2 removable head

i) The body and heads must be constructed of a metal or of a metal alloy other than steel or aluminium. Material must be of a suitable type and of adequate thickness in relation to the capacity of the drum and to its intended use.

ii) Chime seams, if any, must be reinforced by the application of separate reinforcing rings. All seams, if any, must be joined (welded, soldered, etc.) in accordance with the technical state-of-the-art for the metal or metal alloy used.

iii) Drums may have rolling hoops, either expanded or separate. If there are separate rolling hoops, they must be fitted tightly on the body and so secured that they cannot shift. Rolling hoops must not be spot welded.

iv) Openings for filling, emptying and venting in the bodies or heads or non-removable head (1N1) drums must not exceed 7 cm in diameter. Drums with larger openings are considered to be of the removable head type (1N2). Closures for openings in the bodies and heads of drums must be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Closure flanges must be joined in place (welded, soldered, etc.) in accordance with the technical state of the art for the metal or metal alloy used so that the seam join is leakproof. Gaskets or other sealing elements must be used with closures, unless the closure is inherently leakproof.

v) Closure devices for removable head drums must be so designed and applied that they will remain secure and drums will remain leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with all removable heads.

vi) If materials used for body, heads, closures and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments must be applied. These coatings or treatments must retain their protective properties under normal conditions of transport.

vii) Maximum capacity of drum: 450 L.

viii) Maximum net mass: 400 kg.

d) Steel or aluminium jerricans

3A1 steel, non-removable head 3A2 steel, removable head
3B1 aluminium, non-removable head 3B2 aluminium, removable head

i) Body and heads must be constructed of a steel sheet of aluminium at least 99 per cent pure or of an aluminium base alloy. Material must be of a suitable type and of adequate thickness in relation to the capacity of the jerrican and to its intended use.

ii) Chimes of steel jerricans must be mechanically seamed or welded. Body seams of steel jerricans intended to contain more than 40 L of liquid must be welded. Body seams of steel jerricans intended to contain 40 L or less must be mechanically seamed or welded. For aluminium jerricans, all seams must be welded. Chime seams, if any, must be reinforced by the application of a separate reinforcing ring.

iii) Openings in jerricans (3A1 and 3B1) must not exceed 7 cm in diameter. Jerricans with larger openings are considered to be of the removable head type (3A2 and 3B2). Closures must be so designed that they will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with closures, unless the closure is inherently leakproof.

iv) If materials used for body, heads, closures and fittings are not in themselves compatible with the contents to be transported, suitable internal protective coatings or treatments must be applied. These coatings or treatments must retain their protective properties under normal conditions of transport.

v) maximum capacity of jerrican: 60 L.

vi) Maximum net mass: 120 kg.

e) Plywood drums

1D

i) The wood used must be well seasoned, commercially dry and free from any defect likely to lessen the effectiveness of the drum for the purpose intended. If a material other than plywood is used for the manufacture of the heads, it must be of a quality equivalent to the plywood.

ii) At least two-ply plywood must be used for the body and at least three-ply plywood for the heads; the plies must be firmly glued together by a water-resistant adhesive with their grain crosswise.

iii) The body and heads of the drum and their joins must be of a design appropriate to the capacity of the drum and to its intended use.

iv) In order to prevent sifting of the contents, lids must be lined with kraft paper or some other equivalent material which must be securely fastened to the lid and extend to the outside along its full circumference.

v) Maximum capacity of drum: 250 L.

vi) Maximum net mass: 400 kg.

f) Fibre drums

1G

i) The body of the drum must consist of multiple plies of heavy paper or fibreboard (without corrugations) firmly glued or laminated together and may include one or more protective layers of bitumen, waxed kraft paper, metal foil, plastic material, etc.

ii) Heads must be of natural wood, fibreboard, metal, plywood, plastic or other suitable material and may include one or more protective layers of bitumen, waxed kraft paper, metal foil, plastic material, etc.

iii) The body and heads of the drum and their joins must be of a design appropriate to the capacity of the drum and to its intended use.

iv) The assembled packaging must be sufficiently water-resistant so as not to delaminate under normal conditions of transport.

v) Maximum capacity of drum: 450 L.

vi) Maximum net mass: 400 kg.

g) Plastic drums and jerricans

1H1 drums, non-removable head 1H2 drums, removable head

3H1 jerricans, non-removable head 3H2 jerricans, removable head

i) The packaging must be manufactured from suitable plastic material and be of adequate strength in relation to its capacity and intended use. Except for recycled plastic material as defined in 1;3, no used material other than production residues or regrind from the same manufacturing process may be used. The packaging must be adequately resistant to aging and to degradation caused either by the substance contained or by ultraviolet radiation. Any permeation of the substance contained must not constitute a danger under normal conditions of transport.

ii) If protection against ultraviolet radiation is required, it must be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives must be compatible with the contents and remain effective throughout the life of the packaging. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, retesting may be waived if the carbon black content does not exceed 2 per cent by mass or if the pigment

content does not exceed 3 per cent by mass; the content of inhibitors of ultraviolet radiation is not limited.

iii) Additives serving purposes other than protection against ultraviolet radiation may be included in the composition of the plastic material provided that they do not adversely affect the chemical and physical properties of the material of the packaging. In such circumstances retesting may be waived.

iv) The wall thickness at every point of the packaging must be appropriate to its capacity and intended use, taking into account the stresses to which each point is liable to be exposed.

v) Openings for filling, emptying and venting in the bodies or heads of non-removable head drums (1H1) and jerricans (3H1) must not exceed 7 cm in diameter. Drums and jerricans with larger openings are considered to be of the removable head type (1H2 and 3H2). Closures for openings in the bodies or heads of drums and jerricans must be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Gaskets or other sealing elements must be used with closures unless the closure is inherently leakproof.

vi) Closure devices for removable head drums and jerricans must be so designed and applied that they will remain secure and leakproof under normal conditions of transport. Gaskets must be used with all removable heads unless the drum or jerrican design is such that, where the removable head is properly secured, the drum or jerrican is inherently leakproof.

vii) Maximum capacity of drums and jerricans:

1H1, 1H2: 450 L;
3H1, 3H2: 60 L.

viii) Maximum net mass:

1H1, 1H2: 400 kg;
3H1, 3H2: 120 kg.

h) Boxes of natural wood

4C1 ordinary
4C2 with siftproof walls

i) The wood used must be well seasoned, commercially dry and free from defects that would materially lessen the strength of any part of the box. The strength of the material used and the method of construction must be appropriate to the capacity and intended use of the box. The tops and bottoms may be made of water-resistant reconstituted wood such as hardboard, particle board or other suitable type.

ii) Fastenings must be resistant to vibration experienced under normal conditions of transport. End grain nailing must be avoided whenever practicable. Joins which are likely to be highly stressed must be made using clenched or annular ring nails or equivalent fastenings.

iii) Box 4C2: each part must consist of one piece or be equivalent thereto. Parts are considered equivalent to one piece when one of the following methods of glued assembly is used: Lindermann

joint, tongue and groove joint, ship lap or rabbet joint or butt joint with at least two corrugated metal fasteners at each joint.

iv) Maximum net mass: 400 kg.

i) Plywood boxes
4D

i) Plywood used must be at least 3-ply. It must be made from well seasoned rotary cut, sliced or sawn veneer, commercially dry and free from defects that would materially lessen the strength of the box. The strength of the material used and the method of construction must be appropriate to the capacity and intended use of the box. All adjacent plies must be glued with water-resistant adhesive. Other suitable materials may be used together with plywood in the construction of boxes. Boxes must be firmly nailed or screwed to corner posts or ends or be assembled by equally suitable devices.

ii) Maximum net mass: 400 kg

j) Reconstituted wood boxes
4F

i) The walls of boxes must be made of water-resistant reconstituted wood such as hardboard, particle board or other suitable type. The strength of the material used and the method of construction must be appropriate to the capacity of the boxes and their intended use.

ii) Other parts of the boxes may be made of other suitable material.

iii) Boxes must be securely assembled by means of suitable devices.

iv) Maximum net mass: 400 kg.

k) Fibreboard boxes (including corrugated fibreboard boxes)
4G

i) Strong and good quality solid or double-faced corrugated fibreboard (single or multiwall) must be used, appropriate to the capacity of the box and to its intended use. The water resistance of the outer surface must be such that the increase in mass, as determined in a test carried out over a period of 30 minutes by the Cobb method of determining water absorption, is not greater than 155 g/m2 – see ISO 535:2014. It must have proper bending qualities. Fibreboard must be cut, creased without scoring, and slotted so as to permit assembly without cracking, surface breaks or undue bending. The fluting of corrugated fibreboard must be firmly glued to the facings.

ii) The ends of boxes may have a wooden frame or be entirely of wood or other suitable material. Reinforcements of wooden battens or other suitable material may be used.

iii) Manufacturing joins in the body of boxes must be taped, lapped and glued or lapped and stitched with metal staples. Lapped joins must have an appropriate overlap.

iv) Where closing is effected by gluing or taping, a water-resistant adhesive must be used.

v) Boxes must be designed so as to provide a good fit to the contents.

vi) Maximum net mass: 400 kg

l) Plastic boxes

4H1 expanded plastic boxes 4H2 solid plastic boxes

i) The box must be manufactured from suitable plastic material and be of adequate strength in relation to its capacity and intended use. The box must be adequately resistant to aging and to degradation caused either by the substance contained or by ultraviolet radiation.

ii) An expanded plastic box must comprise two parts made of a moulded expanded plastic material, a bottom section containing cavities for the inner packagings and a top section covering and interlocking with the bottom section. The top and bottom sections must be designed so that the inner packagings fit snugly. The closure cap for any inner packaging must not be in contact with the inside of the top section of this box.

iii) For dispatch, an expanded plastic box must be closed with a self-adhesive tape having sufficient tensile strength to prevent the box from opening. The adhesive tape must be weather-resistant and its adhesive compatible with the expanded plastic material of the box. Other closing devices at least equally effective may be used.

iv) For solid plastic boxes, protection against ultraviolet radiation, if required, must be provided by the addition of carbon black or other suitable pigments or inhibitors. These additives must be compatible with the contents and remain effective throughout the life of the box. Where use is made of carbon black, pigments or inhibitors other than those used in the manufacture of the tested design type, re-testing may be waived if the carbon black content does not exceed 2 per cent by mass or if the pigment content does not exceed 3 per cent by mass; the content of inhibitors of ultraviolet radiation is not limited.

v) Additives serving purposes other than protection against ultraviolet radiation may be included in the composition of the plastic material provided that they do not adversely affect the chemical or physical properties of the material of the box. Under such circumstances re-testing may be waived.

vi) Solid plastic boxes must have closure devices made of a suitable material, of adequate strength and so designed as to prevent the box from unintentional opening.

vii) Maximum net mass:

4H1 box: 60 kg;
4H2 box: 400 kg.

m) Steel, aluminium or other metal boxes

4A steel 4B aluminium

4N metal, other than steel or aluminium

i) The strength of the metal and the construction of the box must be appropriate to the capacity of the box and to its intended use.

ii) Boxes must be lined with fibreboard or felt packing pieces or must have an inner liner or coating of suitable material as required. If a double seamed metal liner is used, steps must be taken to prevent the ingress of substances, particularly explosives, into the recesses of the seams.

iii) Closures may be of any suitable type; they must remain secured under normal conditions of transport.

iv) Maximum net mass: 400 kg.

n) Textile bags

5L2 siftproof 5L3 water-resistant

i) The textiles used must be of good quality. The strength of the fabric and the construction of the bag must be appropriate to the capacity of the bag and to its intended use.

ii) Bags, siftproof, 5L2: the bag must be made siftproof, for example by the use of:

— paper bonded to the inner surface of the bag by a water-resistant adhesive such as bitumen; or — plastic film bonded to the inner surface of the bag; or

— one or more inner liners made of paper or plastic material.

iii) Bags, water-resistant, 5L3: to prevent the entry of moisture the bag must be made waterproof, for example by the use of:

— separate inner liners of water-resistant paper (such as waxed kraft paper, tarred paper or plastic-coated kraft paper); or

— plastic film bonded to the inner surface of the bag; or

— one or more inner liners made of plastic material.

iv) Maximum net mass: 50 kg.

o) Woven plastic bags

5H1 without inner lining or coating 5H2 siftproof
5H3 water-resistant

i) Bags must be made from stretched tapes or monofilaments of a suitable plastic material. The strength of the material used and the construction of the bag must be appropriate to the capacity of the bag and to its intended use.

ii) If the fabric is woven flat, the bags must be made by sewing or some other method ensuring closure of the bottom and one side. If the fabric is tubular, the bag must be closed by sewing, weaving or some other equally strong method of closure.

iii) Bags, siftproof, 5H2: The bag must be made siftproof, for example by means of:

— paper or a plastic film bonded to the inner surface of the bag; or

— one or more separate inner liners made of paper or plastic material.

iv) Bags, water-resistant, 5H3: To prevent the entry of moisture, the bag must be made waterproof, for example by means of:

— separate inner liners of water-resistant paper (such as waxed kraft paper, double-tarred kraft paper or plastic-coated kraft paper); or

— plastic film bonded to the inner or outer surface of the bag; or

— one or more inner plastic liners.

v) Maximum net mass: 50 kg.

p) Plastic film bags
5H4

i) Bags must be made of a suitable plastic material. The strength of the material used and the construction of the bag must be appropriate to the capacity of the bag and to its intended use. Joins and closures must withstand pressures and impacts liable to occur under normal conditions of transport.

ii) Maximum net mass: 50 kg.

q) Paper bags
5M1 multiwall
5M2 multiwall, water-resistant

i) Bags must be made of a suitable kraft paper or of an equivalent paper with at least three plies, the middle ply of which may be net-cloth and adhesive bonding to the outer paper plies. The strength of the paper and the construction of the bags must be appropriate to the capacity of the bag and to its intended use. Joins and closures must be siftproof.

ii) To prevent the entry of moisture, a bag of four plies or more must be made waterproof by the use of either a water-resistant ply as one of the two outermost plies or a water-resistant barrier made of a suitable protective material between the two outermost plies. A bag of three plies must be made waterproof by the use of a water-resistant ply as the outermost ply. Where there is a danger of the substance contained reacting with moisture or where it is packed damp, a waterproof ply or barrier, such as double-tarred kraft paper, plastic-coated kraft paper, plastic film bonded to the inner surface

of the bag, or one or more inner plastic liners, must also be placed next to the substance. Joins and closures must be waterproof.

iii) Maximum net mass: 50 kg.

r) Composite packagings (plastic material)

6HA1 plastic receptacle with outer steel drum 6HA2 plastic receptacle with outer steel crate*/or box
6HB1 plastic receptacle with outer aluminium drum
6HB2 plastic receptacle with outer aluminium crate*/or box 6HC plastic receptacle with outer wooden box
6HD1 plastic receptacle with outer plywood drum 6HD2 plastic receptacle with outer plywood box
6HG1 plastic receptacle with outer fibre drum 6HG2 plastic receptacle with outer fibreboard box
6HH1 plastic receptacle with outer plastic drum 6HH2 plastic receptacle with outer solid plastic box

i) Inner receptacle

ii) The inner plastic receptacle must fit snugly inside the outer packaging, which must be free of any projection that might abrade the plastic material.

iii) Maximum capacity of inner receptacles:

6HA1, 6HB1, 6HD1, 6HG1, 6HH1: 250 L;
6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2: 60 L.

iv) Maximum net mass:

6HA1, 6HB1, 6HD1, 6HG1, 6HH1: 400 kg;
6HA2, 6HB2, 6HC, 6HD2, 6HG2, 6HH2: 75 kg.

v) Outer packaging

vi) Plastic receptacle with outer steel or aluminium drum 6HA1 or 6HB1; the relevant provisions of c) and d) as appropriate, apply to the construction of the outer packaging.

2) REQUIREMENTS FOR INNER PACKAGINGS

a) **Glass**

Packagings must be well constructed. The materials of which these packagings and closures are made must be of good quality and, where in contact with the substance or article, not liable to react with it. Closures must be sufficiently tight to prevent leaking and sifting. Stoppers or corks must be held securely in position with wire, adhesive tape, or other positive means. Packagings having necks with moulded screw-threads must have threaded-type caps having a resilient liner completely resistant to the contents.

Glass ampoules must be heat-sealed, gas- and liquid-tight and they must not react chemically when coming into contact with the contents. If glass tubes are also permitted by the appropriate national authority for liquefied gases, they must be thick-walled and free of defects.

b) Plastic

Packagings must be well constructed. The materials of which these packagings and closures are made must be of good quality polyethylene or other suitable plastic and, where in contact with the substance, resistant to it. Closures must be sufficiently tight to prevent leaking and sifting. Stoppers or corks must be held securely in position with wire, adhesive tape, or other positive means.

c) Metal cans, tins or tubes

Packagings must be well constructed. The materials of which the packagings and closures are made must be of good quality and, where in contact with the substance, not liable to react with it. Closures must be sufficiently tight to prevent leaking and sifting and threaded-type caps must be equipped with a resilient liner completely resistant to the contents of the packagings.

d) Paper bags

The weld-seams and closures of such bags must be siftproof. Plastic bags must have a minimum thickness of 0.1 mm.

e) Fibre cans or boxes

Packagings must be well constructed and the material of which they are made must be of good quality. Metal tops, bottoms and connections, of suitable thickness, are authorized

f) Metal or plastic flexible tubes

The materials of construction of flexible tubes and their closures must, where in contact with the organic peroxide, not affect the thermal stability.

3. PACKAGING PERFORMANCE TESTS

1) PERFORMANCE AND FREQUENCY OF TESTS

a) The design type of each packaging must be tested as provided for in this Chapter in accordance with procedures established by the appropriate national authority.

b) Each packaging design type must successfully pass the tests prescribed in this chapter before being used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes packagings which differ from the design type only in their lesser design height.

c) Tests must be repeated on production samples at intervals established by the appropriate national authority. For such tests on paper or fibreboard packagings, preparation at ambient conditions is considered equivalent to the provisions.

d) Tests must also be repeated after each modification which alters the design, material or manner of construction of a packaging.

e) The appropriate national authority may permit the selective testing of packagings that differ only in minor respects from a tested type, such as smaller sizes of inner packagings or inner packagings of lower net mass; and packagings such as drums, bags and boxes which are produced with small reductions in external dimension(s).

f) Articles or inner packagings of any type for solids or liquids may be assembled and transported, without testing, in an outer packaging under the following conditions:

i) The outer packaging must have been successfully tested with fragile (such as glass) inner packagings containing liquids using the Packing Group I drop height.

ii) The total combined gross mass of inner packagings must not exceed one-half the gross mass of inner packagings used for the drop test in a) above.

iii) The thickness of cushioning material between inner packagings and between inner packagings and the outside of the packaging must not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single inner packaging was used in the original test, the thicknesses of cushioning between inner packagings must not be less than the thickness of cushioning between the outside of the packaging and the inner packaging in the original test. If either fewer or smaller inner packagings are used (as compared to the inner packagings used in the drop test), sufficient additional cushioning material must be used to take up void spaces.

iv) The outer packaging must have passed successfully the stacking test, while empty. The total mass of identical packages must be based on the combined mass of inner packagings used for the drop test above.

v) Inner packagings containing liquids must be completely surrounded with a sufficient quantity of absorbent material to absorb the entire liquid contents of the inner packagings.

vi) If the outer packaging is intended to contain inner packagings for liquids and is not leakproof, or is intended to contain inner packagings for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally efficient means of containment. For packagings containing liquids, the absorbent material required by e) above must be placed inside the means of containing the liquid contents.

vii) Packagings must be marked in accordance as having been tested to Packing Group I performance for combination packagings. The marked gross mass in kilograms must be the sum of the mass of the outer packaging plus one half of the mass of the inner packaging(s) as used for the drop test referred to in a) above. Such a packaging mark must also contain a letter "V".

g) The appropriate national authority may at any time require proof, by tests in accordance with this Chapter, that serially produced packagings meet the requirements of the design type tests.
h) If an inner treatment or coating is required for safety reasons, it must retain its protective properties even after the tests.
i) Provided the validity of the test results is not affected, and with the approval of the appropriate national authority, several tests may be made on one sample.

2) PREPARATION OF PACKAGINGS FOR TESTING

a) Tests must be carried out on packagings prepared as for transport including, with respect to combination packagings, the inner packagings used. Inner or single receptacles or packagings must be filled to not less than 98 per cent of their maximum capacity for liquids or 95 per cent for solids. Bags must only be filled to the maximum mass at which they may be used. For other than bags, combination packagings where the inner packaging is designed to carry liquids and solids, separate testing is required for both liquid and solid contents. The substances or articles to be transported in the packaging may be replaced by other substances or articles except where this would invalidate the results of the tests. For solids, when another substance is used it must have the same physical characteristics (mass, grain size, etc.) as the substance to be carried. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass, so long as they are placed so that the test results are not invalidated.

b) In the drop tests for liquids, when another substance is used, it must be of similar relative density and viscosity to those of the substance being transported. Water may also be used for the liquid drop test under the conditions set forth.

c) Paper or fibreboard packagings must be conditioned for at least 24 hours in an atmosphere having a controlled temperature and relative humidity (r.h.). There are three options, one of which must be chosen.

3) DROP TEST

a) Number of test samples (per design type and manufacturer) and drop orientation.

For other than flat drops, the centre of gravity must be vertically over the point of impact. Where more than one orientation is possible for a given drop, the orientation most likely to result in failure of the packaging must be used.

Packaging	*Number of test samples*	*Drop orientation*
Steel drums Aluminium drums Steel jerricans Aluminium jerricans Plywood drums Fibre drums Plastic drums and jerricans Composite packagings which are in the shape of a drum	Six (three for each drop)	First drop (using three samples): the packaging must strike the target diagonally on the chime or, if the packaging has no chime, on a circumferential seam or an edge. Second drop (using the other three samples): the packaging must strike the target on the weakest part not tested by the first drop, for example a closure or, for some cylindrical drums, the welded longitudinal seam of the drum body.
Boxes of natural wood Plywood boxes Reconstituted wood boxes Fibreboard boxes Plastic boxes Steel or aluminium boxes Composite packagings which are in the shape of a box	Five (one for each drop)	First drop: flat on the bottom Second drop: flat on the top Third drop: flat on the long side Fourth drop: flat on the short side Fifth drop: on a corner
Bags – single-ply without a side seam, or multi-ply	Three (two drops per bag)	First drop: flat on a wide face Second drop: on an end of the bag
Bags – single-ply with a side seam	Three (three drops per bag)	First drop: flat on a wide face Second drop: flat on a narrow face Third drop: on an end of the bag

b) Special preparation of test samples for the drop test

i) The temperature of the test sample and its contents must be reduced to –18°C or lower for the following packagings:

plastic drums

plastic jerricans

plastic boxes other than expanded polystyrene boxes

composite packagings (plastic material) ; and

combination packagings with plastic inner packagings, other than plastic bags intended to contain solids or articles.

ii) Where test samples are prepared in this way, the conditioning specified may be waived. Test liquids must be kept in the liquid state by the addition of antifreeze, if necessary.

iii) Removable head packagings for liquids must not be dropped until at least 24 hours after filling and closing to allow for any possible gasket relaxation

c) Target

The target must be a non-resilient horizontal surface and must be:

i) integral and massive enough to be immovable;

ii) flat with a surface kept free from local defects capable of influencing the test results;

iii) rigid enough to be non-deformable under test conditions and not liable to become damaged by the tests; and

iv) sufficiently large to ensure that the test package falls entirely upon the surface.

d) Drop height

For solids and liquids, if the test is performed with the solid or liquid to be transported or with another substance having essentially the same physical characteristics:

Packing Group I	Packing Group II	Packing Group III
1.8 m	1.2 m	0.8 m

For liquids in single packagings and for inner packagings of combination packagings, if the test is performed with water:

where the substances to be transported have a relative density not exceeding 1.2:

Packing Group I	Packing Group II	Packing Group III
1.8 m		0.8 m

i)where the substances to be transported have a relative density exceeding 1.2, the drop height must be calculated on the basis of the relative density (d) of the substance to be carried, rounded up to the first decimal, as follows:

Packing Group I	Packing Group II	Packing Group III
d × 1.5 m	d × 1.0 m	d × 0.67 m

e) Criteria for passing the test

i) Each packaging containing liquid must be leakproof when equilibrium has been reached between the internal and external pressures, except for inner packagings of combination packagings when it is not necessary that the pressures be equalized.

ii) Where a packaging for solids undergoes a drop test and its upper face strikes the target, the test sample passes the test if the entire contents are retained by an inner packaging or inner receptacle (such as a plastic bag) even if the closure, while retaining its containment function, is no longer siftproof.

iii) The packaging or outer packaging of a composite or combination packaging must not exhibit any damage liable to affect safety during transport. Inner receptacles, inner packagings, or articles must remain completely within the outer packaging and there must be no leakage of the filling substance from the inner receptacle or inner packaging(s).

iv) Neither the outermost ply of a bag nor an outer packaging may exhibit any damage liable to affect safety during transport.

v) A slight discharge from the closure(s) upon impact is not considered to be a failure of the packaging provided that no further leakage occurs.

vi) No rupture is permitted in packagings for goods of Class 1 which would permit the spillage of loose explosive substances or articles from the outer packaging.

4) LEAKPROOFNESS TEST

a) Number of test samples: three test samples per design type and manufacturer.

Test method and pressure to be applied: the packagings including their closures must be restrained under water for 5 minutes while an internal air pressure is applied; the method of restraint must not affect the results of the test. The air pressure (gauge) to be applied must be:

Packing Group I	Packing Group II	Packing Group III
Not less than 30 kPa (0.3 bar)	Not less than 20 kPa (0.2 bar)	Not less than 20 kPa (0.2 bar)

Other methods at least equally effective may be used. Criterion for passing the test: there must be no leakage.

5) INTERNAL PRESSURE (HYDRAULIC) TEST

a) Packagings to be tested: the internal pressure (hydraulic) test must be carried out on all design types of metal, plastic and composite packagings intended to contain liquids. This test is not required for the inner packagings of combination packagings.

b) Number of test samples: three test samples per design type and manufacturer.

c) Test method and pressure to be applied: metal packagings including their closures must be subjected to the test pressure for 5 minutes. Plastic packagings and composite packagings (plastic material) including their closures must be subjected to the test pressure for 30 minutes. This pressure is the one to be included in the mark required by 2.1.1 d). The manner in which the packagings are supported must not invalidate the test. The test pressure must be applied continuously and evenly: it must be kept constant throughout the test period. The hydraulic pressure (gauge) applied, as determined by any one of the following methods, must be:

i) not less than the total gauge pressure measured in the packaging (that is, the vapour pressure of the filling liquid and the partial pressure of the air or other inert gases minus 100 kPa) at 55°C, multiplied by a safety factor of 1.5. This total gauge pressure must be determined on the basis of a maximum degree and a filling temperature of 15°C. The test pressure must be not less than 95 kPa (not less than 75 kPa for liquids in Packing Group III of Class 3, Division 6.1 or Class 9); or

ii) not less than 1.75 times the vapour pressure at 50°C of the liquid to be transported, minus 100 kPa but with a minimum test pressure of 100 kPa; or

not less than 1.5 times the vapour pressure at 55°C of the liquid to be transported, minus 100 kPa but with a minimum test pressure of 100 kPa.

iii) These are expressed as:

1. PT = (PM55 × 1.5) kPa with minima of 95 or 75 kPa;
2. PT = (Vp50 × 1.75) – 100 kPa with a minimum of 100 kPa;
3. PT = (Vp55 × 1.5) – 100 kPa with a minimum of 100 kPa;
4. where:

P_T = Test pressure in kPa (gauge)

P = Pressure measured in the filled packaging at a

M5 = temperature of 55°C Vapour pressure at 50°C

5 = Vapour pressure at 55°C.

Vp

5

Vapour pressure at 55°C.

In addition, packagings intended to contain liquids of Packing Group I must be tested to a minimum test pressure of 250 kPa (gauge) for a test period of 5 or 30 minutes depending upon the material of construction of the packaging.

Criteria for passing the test: no packaging may leak.

6) STACKING TEST

a) All design types of packagings other than bags must be subjected to a stacking test.

b) Number of test samples: three test samples per design type and manufacturer.

c) Test method: the test sample must be subjected to a force applied to the top surface of the test sample equivalent to the total weight of identical packages which might be stacked on it during transport: where the contents of the test samples are liquids with a relative density different from that of the liquid to be transported, the force must be calculated in relation to the latter. The minimum height of the stack including the test sample must be 3 m. The duration of the test must be 24 hours except that plastic drums, jerricans and composite packagings (6HH1 and 6HH2) intended for liquids must be subjected to the stacking test for a period of 28 days at a temperature of not less than 40°C.

d) Criteria for passing the test: no test sample may leak. In composite packagings or combination packagings, there must be no leakage of the filling substance from the inner receptacle or inner packaging. No test sample must show any deterioration which could adversely affect transport safety or any distortion liable to reduce its strength or cause instability in stacks of packages. Plastic packagings must be cooled to ambient temperature before the assessment.

7) TEST REPORT

a) A test report containing at least the following particulars must be drawn up and must be available to the users of the packaging:
i) name and address of the test facility;
ii) name and address of the applicant (where appropriate);
iii) a unique test report identification;
iv) date of the test report;
v) manufacturer of the packaging;
vi) description of the packaging type (such as dimensions, materials, closures, thickness, etc.), including method of manufacture (such as blow moulding); drawings and/or photographs may be included;
vii) maximum capacity;
Viii) characteristics of the test contents (such as the viscosity and relative density for liquids and the particle size for solids) (for plastics packagings subject to the internal pressure test in 4.5, the temperature of the water used);
ix) test descriptions and results;
x) a signature and name and status of the signatory.

b) The test report must contain statements that:
i) the packaging prepared as for transport was tested in accordance with the appropriate provisions of these standards or the equivalent provisions of Chapter 6 of the United Nations Recommendations on the Transport of Dangerous Goods; and
ii) the use of other packaging methods or components may render it invalid.
d) A copy of the test report must be made available to the appropriate national authority.

8) TEST REQUIREMENTS FOR SALVAGE PACKAGING

Salvage packagings must be tested and marked in accordance with the requirements applicable to Packing Group II packagings intended for the transport of solids or inner packagings, except as follows:

a) the test substance used in performing the tests must be water, and the packagings must be filled to not less than 98 per cent of their maximum capacity. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass so long as they are placed so that the test results are not affected. In performing the drop test, the drop height must meet the requirements of 3(d);
b) packagings must have been successfully leakproofness tested at 30 kPa with the test results reflected in the test report required by 4(g);
c) packagings for which retention of liquids is a basic function must, in addition, have been successfully tested in accordance with the internal pressure test specified in 5.

4. REQUIREMENTS FOR THE CONSTRUCTION AND TESTING OF CYLINDERS AND CLOSED CRYOGENIC RECEPTACLES, AEROSOL DISPENSERS AND SMALL RECEPTACLES CONTAINING GAS (GAS CARTRIDGES) AND FUEL CELL CARTRIDGES CONTAINING LIQUEFIED FLAMMABLE GAS

1) GENERAL REQUIREMENTS

a) Design and construction

i) Cylinders and closed cryogenic receptacles must be designed, manufactured, tested and equipped in such a way as to withstand all conditions, including fatigue, to which they will be subjected during normal conditions of transport and intended use.

ii) In recognition of scientific and technological advances, and recognizing that cylinders and closed cryogenic receptacles other than those that bear “UN” certification marks may be used on a national or regional basis, cylinders and closed cryogenic receptacles conforming to requirements other than those

specified in these standards may be used if approved by the appropriate national authorities in the countries of transport and use.

iii) In no case must the minimum wall thickness be less than that specified in the design and construction technical standards.

iv) For welded cylinders and closed cryogenic receptacles, only metals of weldable quality must be welded.

v)The test pressure of cylinder shells must be in accordance with Packing Instruction 200 or, for a chemical under pressure, with Packing Instruction 218. The test pressure for closed cryogenic receptacles must be in accordance with Packing Instruction 202. The test pressure of a metal hydride storage system must be in accordance with Packing Instruction 214. The test pressure of a cylinder shell for an adsorbed gas must be in accordance with Packing Instruction 219.

vi) Contact between dissimilar metals which could result in damage by galvanic action must be avoided.

vii) The following additional requirements apply to the construction of closed cryogenic receptacles for refrigerated liquefied gases.

viii) The mechanical properties of the metal used must be established for each closed cryogenic receptacle, including the impact strength and the bending coefficient.

ix) The closed cryogenic receptacles must be thermally insulated. The thermal insulation must be protected against impact by means of a jacket. If the space between the inner vessel and the jacket is evacuated of air (vacuum-insulation), the jacket must be designed to withstand without permanent deformation an external pressure of at least 100 kPa (1 bar) calculated in accordance with a recognized technical code or a calculated critical collapsing pressure of not less than 200 kPa (2 bar) gauge pressure. If the jacket is so closed as to be gas-tight (such as in the case of vacuum-insulation), a device must be provided to prevent any dangerous pressure from developing in the insulating layer in the event of inadequate gas-tightness of the inner vessel or its service equipment. The device must prevent moisture from penetrating into the insulation.

x) Closed cryogenic receptacles intended for the transport of refrigerated liquefied gases having a boiling point below –182°C at atmospheric pressure must not include materials that may react with oxygen or oxygen-enriched atmospheres in a dangerous manner when located in parts of the thermal insulation where there is a risk of contact with oxygen or oxygen-enriched liquid.

xi) Closed cryogenic receptacles must be designed and constructed with suitable lifting and securing arrangements.

xii) Additional requirements for the construction of acetylene cylinders

Cylinder shells for UN 1001 – Acetylene, dissolved and UN 3374 – Acetylene, solvent free must be filled with a porous mass, uniformly distributed, of a type that conforms to the requirements and testing specified by a standard or technical code recognized by the appropriate national authority and which:

- is compatible with the cylinder shell and does not form harmful or dangerous compounds either with the acetylene or with the solvent in the case of UN 1001; and
- is capable of preventing the spread of decomposition of the acetylene in the porous material.

In the case of UN 1001, the solvent must be compatible with those parts of the cylinder that are in contact with it.

b) Materials

i) Construction materials of cylinders and closed cryogenic receptacles which are in direct contact with dangerous goods must not be affected or weakened by the dangerous goods intended and must not cause a dangerous effect (such as catalysing a reaction or reacting with the dangerous goods).

ii) Cylinders and closed cryogenic receptacles must be made of the materials specified in the design and construction technical standards and the applicable packing instruction for the substances intended for transport in the cylinder and closed cryogenic receptacle. The materials must be resistant to brittle fracture and to stress corrosion cracking as indicated in the design and construction technical standards.

c) Service equipment

i) Service equipment subjected to pressure, excluding:

- porous, absorbent or adsorbent material;
- pressure relief devices;
- pressure gauges; or
- indicators;

must be designed and constructed so that the burst pressure is at least 1.5 times the test pressure of the cylinders and closed cryogenic receptacles.

ii) Service equipment must be configured or designed to prevent damage and unintended opening that could result in the release of the cylinder and closed cryogenic receptacle contents during normal conditions of handling and transport. All closures must be protected in the same manner as is required for valves.

iii) Cylinders and closed cryogenic receptacles that are not capable of being handled manually or rolled must be fitted with handling devices (skids, rings, straps) ensuring that they can be safely handled by mechanical means and arranged so as not to impair the strength of, nor cause undue stresses in, the cylinder and closed cryogenic receptacle.

iv) Individual cylinders and closed cryogenic receptacles must be equipped with pressure relief devices as specified in Packing Instruction 200(1), 202 or 214. Pressure-relief devices must be designed to prevent the entry of foreign matter, the leakage of gas and the development of any dangerous excess pressure.

v)Cylinders and closed cryogenic receptacles whose filling is measured by volume must be provided with a level indicator.

vi) For sections of piping which can be closed at both ends and where liquid product can be trapped, a method of automatic pressure-relief must be provided to prevent excess pressure build-up within the piping.

vii) Each connection to a closed cryogenic receptacle must be clearly marked to indicate its function (such as vapour or liquid phase).

viii) Every closed cryogenic receptacle, having a nominal capacity in excess of 550 L, must be provided with at least two pressure-relief devices. The pressure-relief device must be of the type that will resist dynamic forces including surge.

ix) Closed cryogenic receptacles, having a nominal capacity of 550 L or less, must be provided with at least one pressure-relief device and may, in addition have a frangible disc in parallel with the spring-loaded device in order to meet the requirements of 5.1.3.6.5. The pressure-relief device must be of the type that will resist dynamic forces including surge.

x) Connections to pressure-relief devices must be of sufficient size to enable the required discharge to pass unrestricted to the pressure-relief device.

xi) All pressure-relief device inlets must, under maximum filling conditions, be situated in the vapour space of the closed cryogenic receptacle and the devices must be so arranged as to ensure that the escaping vapour is discharged unrestrictedly.

xii) The pressure-relief device must open automatically at a pressure not less than the MAWP and be fully open at a pressure equal to 110 per cent of the MAWP. It must, after discharge, close at a pressure not lower than 10 per cent below the pressure at which discharge starts and must remain closed at all lower pressures.

xiii) In the case of the loss of vacuum in a vacuum-insulated closed cryogenic receptacle, the combined capacity of all pressure-relief devices installed must be sufficient so that the pressure (including accumulation) inside the closed cryogenic receptacle does not exceed 120 per cent of the MAWP.

xiv) The required capacity of the pressure-relief devices must be calculated in accordance with an established technical code recognized by the appropriate national authority.

d) Approval of cylinders and closed cryogenic receptacles

i) The conformity of cylinders and closed cryogenic receptacles must be assessed at the time of manufacture as required by the appropriate national authority. The technical documentation must include full specifications on design and construction, and full documentation on the manufacturing and testing.

ii) Quality assurance systems must conform to the requirements of the appropriate national authority.

iii) Cylinder shells and the inner vessels of closed cryogenic receptacles must be inspected, tested and approved by an inspection body.

iv) For refillable cylinders, the conformity assessment of the shell and the closure(s) may be carried out separately. In these cases, an additional assessment of the final assembly is not required.

v) For closed cryogenic receptacles, the inner vessels and the closures may be assessed separately, but an additional assessment of the complete assembly is required.

vi) For acetylene cylinders, conformity assessment must comprise either:

- one assessment of conformity covering both the cylinder shell and the contained porous material; or
- a separate assessment of conformity for the empty cylinder shell and an additional assessment of conformity covering the cylinder shell with the contained porous material.

e) Initial inspection and testing

i)New cylinders, other than closed cryogenic receptacles and metal hydride storage systems, must be subjected to inspection and testing during and after manufacture in accordance with the applicable design standards or recognized technical codes including the following:

On an adequate sample of cylinder shells:

- testing of the mechanical characteristics of the material of construction;
- verification of the minimum wall thickness;
- verification of the homogeneity of the material for each manufacturing batch;
- inspection of the external and internal conditions;
- inspection of the threads used to fit closures;
- verification of the conformance with the design standard; For all cylinder shells:
- a hydraulic pressure test. Cylinder shells must meet the acceptance criteria specified in the design and construction technical standard or technical code;

Note.— With the agreement of the appropriate national authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.

- inspection and assessment of manufacturing defects and either repairing them or rendering the cylinder shells unserviceable. In the case of welded cylinder shells, particular attention must be paid to the quality of the welds;
- an inspection of the marks on the cylinder shells;
- in addition, cylinder shells intended for the transport of UN 1001 – Acetylene, dissolved, and UN 3374 – Acetylene, solvent free, must be inspected to ensure proper installation and condition of the porous material and, if applicable, the quantity of solvent.

On an adequate sample of closures:

- verification of materials;
- verification of dimensions;
- verification of cleanliness;
- inspection of completed assembly;
- verification of the presence of marks; For all closures:
- testing for leakproofness;

ii) Closed cryogenic receptacles must be subjected to testing and inspection during and after manufacture in accordance with the applicable design standards or recognized technical codes, including the following:

On an adequate sample of inner vessels:

- testing of the mechanical characteristics of the material of construction;
- verification of the minimum wall thickness;
- inspection of the external and internal conditions;
- verification of the conformance with the design standard or technical code;
- inspection of welds by radiographic, ultrasonic or other suitable non-destructive test method according to the applicable design and construction standard or technical code;

For all inner vessels:

- a hydraulic pressure test. The inner vessel must meet the acceptance criteria specified in the design and construction technical standard or technical code;

Note.— With the agreement of the competent authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.

- inspection and assessment of manufacturing defects and either repairing them or rendering the inner vessel unserviceable;
- an inspection of the marks; On an adequate sample of closures:
- verification of materials;
- verification of dimensions;
- verification of cleanliness;
- inspection of completed assembly;
- verification of the presence of marks. For all closures:
- testing for leakproofness.

On an adequate sample of completed closed cryogenic receptacles:

- testing the satisfactory operation of service equipment;
- verification of the conformance with the design standard or technical code.

For all completed closed cryogenic receptacles:

- testing for leakproofness.

f) Periodic inspection and testing

i) Refillable cylinders other than cryogenic receptacles must be subjected to periodic inspections and tests by a body authorized by the appropriate national authority, in accordance with the following:

- check of the external conditions of the cylinder and verification of the equipment and the external marks;

- check of the internal conditions of the cylinder (such as internal inspection, verification of minimum wall thickness);
- check of the threads either:

  - if there is evidence of corrosion; or
  - if the closures or other service equipment are removed;

Note 1.— With the agreement of the appropriate national authority, the hydraulic pressure test may be replaced by a test using a gas, where such an operation does not entail any danger.

ii) Cylinders intended for the transport of UN 1001 – Acetylene, dissolved, and UN 3374 – Acetylene, solvent free, must be examined only as specified. In addition, the condition of the porous material (such as cracks, top clearance, loosening, settlement) must be examined.

iii)Pressure relief valves for closed cryogenic receptacles must be subject to periodic inspections and tests.

g) Requirements for manufacturers

i) The manufacturer must be technically able and must possess all resources required for the satisfactory manufacture of cylinders and closed cryogenic receptacles; this relates in particular to qualified personnel:

  - to supervise the entire manufacturing process;
  - to carry out joining of materials; and
  - to carry out the relevant tests.

ii) A proficiency test of the manufacturers of cylinder shells and the inner vessels of closed cryogenic receptacle must in all instances be carried out by an inspection body approved by the competent authority of the country of approval. Proficiency testing of manufacturers of closures must be carried out if the competent authority requires it. This test must be carried out either during design type approval or during production inspection and certification.

h) Requirements for inspection bodies

Inspection bodies must be independent from manufacturing enterprises and competent to perform the tests, inspections and approvals required.

2) REQUIREMENTS FOR UN CYLINDERS AND CLOSED CRYOGENIC RECEPTACLES

a) Design, construction and initial inspection and testing

i) The following standards apply for the design, construction and initial inspection and test of refillable UN cylinder shells, except that inspection requirements related to the conformity assessment system and approval.

Reference	*Title*	*Applicable for manufacture*
ISO 9809-1:1999	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa. *Note.— The note concerning the F factor in section 7.3 of this standard must not be applied for UN cylinders.*	Until 31 December 2018
ISO 9809-1:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.	Until 31 December 2026
ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa.	Until further notice
ISO 9809-2:2000	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa.	Until 31 December 2018
ISO 9809-2:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa.	Until 31 December 2026
ISO 9809-2:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 2: Quenched and tempered steel cylinders and tubes with tensile strength greater than or equal to 1 100 MPa.	Until further notice
ISO 9809-3:2000	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders.	Until 31 December 2018
ISO 9809-3:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders.	Until 31 December 2026
ISO 9809-3:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 3: Normalized steel cylinders and tubes.	Until further notice
ISO 9809-4:2014	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa	Until 31 December 2028
ISO 9809-4:2021	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 4: Stainless steel cylinders with an Rm value of less than 1 100 MPa *Note.— Small quantities are a batch of cylinders not exceeding 200.*	Until further notice
ISO 7866:1999	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing. *Note.— The note concerning the F factor in section 7.2 of this standard must not be applied for UN cylinders. Aluminium alloy 6351A – T6 or equivalent must not be authorized.*	Until 31 December 2020
ISO 7866: 2012+ Cor 1:2014	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing	Until further notice
Reference	*Title*	*Applicable for* *manufacture*
	Note.— Aluminium alloy 6351A or equivalent must not be used.	
ISO 4706:2008	Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below.	Until further notice
ISO 18172-1:2007	Gas cylinders – Refillable welded stainless steel cylinders – Part 1: Test pressure 6 MPa and below.	Until further notice
ISO 20703:2006	Gas cylinders – Refillable welded aluminium-alloy cylinders – Design, construction and testing.	Until further notice

ISO 11119-1:2002	Gas cylinders of composite construction – Specification and test methods – Part 1: Hoop wrapped composite gas cylinders.	Until 31 December 2020
ISO 11119-1:2012	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 L	Until 31 December 2028
ISO 11119-1:2020	Gas cylinders – Design, construction and testing of refillable composite gas cylinders and tubes – Part 1: Hoop wrapped fibre reinforced composite gas cylinders and tubes up to 450 L	Until further notice
ISO 11119-2:2002	Gas cylinders of composite construction – Specification and test methods – Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners.	Until 31 December 2020
ISO 11119-2:2012 + Amd 1:2014	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with load-sharing metal liners.	Until 31 December 2028
ISO 11119-2:2020	Gas cylinders – Design, construction and testing of refillable composite gas cylinders and tubes – Part 2: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with load-sharing metal liners.	Until further notice
ISO 11119-3:2002	Gas cylinders of composite construction – Specification and test methods – Part 3: Fully wrapped fibre reinforced composite gas cylinders with non-load-sharing metallic or non-metallic liners. *Note.— This standard must not be used for linerless cylinders manufactured from two parts joined together.*	Until 31 December 2020
ISO 11119-3:2013	Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction and testing – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with non-load-sharing metallic or non-metallic liners. *Note.— This standard must not be used for linerless cylinders manufactured from two parts joined together.*	Until 31 December 2028
ISO 11119-3:2020	Gas cylinders – Design, construction and testing of refillable composite gas cylinders and tubes – Part 3: Fully wrapped fibre reinforced composite gas cylinders and tubes up to 450 L with non-load-sharing metallic or non-metallic liners or without liners.	Until further notice
ISO 11119-4: 2016	Gas cylinders – Refillable composite gas cylinders – Design, construction and testing – Part 4: Fully wrapped fibre reinforced composite gas cylinders up to 150 L with load-sharing welded metallic liners.	Until further notice

Note 1.— In the above-referenced standards, composite cylinder shells must be designed for a design life of not less than fifteen years.

Note 2.— Composite cylinder shells with a design life longer than fifteen years must not be filled after fifteen years from the date of manufacture, unless the design has successfully passed a service life test programme. The programme must be part of the initial design type approval and must specify inspections and tests to demonstrate that composite cylinder shells manufactured accordingly remain safe to the end of their design life. The service life test programme and the results must be approved by the appropriate national authority of the country of approval that is responsible for the initial approval of the cylinder design. The service life of a composite cylinder shell must not be extended beyond its initial approved design life.

ii) The following standards apply for the design, construction and initial inspection and test of UN acetylene cylinders except that inspection requirements related to the conformity assessment system.

Note.— The maximum of 1 000 L volume as mentioned in the ISO standard ISO 21029-1:2004 Cryogenic vessels, does not apply for refrigerated liquefied gases in closed cryogenic receptacles installed in apparatus (such as MRI or cooling machines).

For the cylinder shell:

Reference	*Title*	*Applicable for manufacture*
ISO 9809-1:1999	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa. *Note.— The note concerning the F factor in section 7.3 of this standard must not be applied for UN cylinders.*	Until 31 December 2018
ISO 9809-1:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.	Until 31 December 2026
ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa.	Until further notice
ISO 9809-3:2000	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders.	Until 31 December 2018
ISO 9809-3:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders.	Until 31 December 2026
ISO 9809-3:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 3: Normalized steel cylinders and tubes.	Until further notice
ISO 4706:2008	Gas cylinders – Refillable welded steel cylinders – Test pressure 60 bar and below	Until further notice
ISO 7866:2012 + Cor 1:2014	Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction and testing *Note.— Aluminium alloy 6351A or equivalent must not be used*	Until further notice

For the acetylene cylinder including the porous mass in the cylinder:

Reference	*Title*	*Applicable for manufacture*
ISO 3807-1:2000	Cylinders for acetylene – Basic requirements – Part 1: Cylinders without fusible plugs.	Until 31 December 2020
ISO 3807-2:2000	Cylinders for acetylene – Basic requirements – Part 2: Cylinders with fusible plugs.	Until 31 December 2020
ISO 3807:2013	Gas cylinders – Acetylene cylinders – Basic requirements and type testing	Until further notice

iii)The following standard applies for the design, construction and initial inspection and test of UN closed cryogenic receptacles, except that inspection requirements related to the conformity assessment system and approval must be in accordance with the Technical Instructions:

Reference	*Title*	*Applicable for manufacture*
ISO 21029-1:2004	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1 000 L volume – Part 1: Design, fabrication, inspection and tests.	Until 31 December 2026
ISO 21029-1:2018 + Amd 1:2019	Cryogenic vessels – Transportable vacuum insulated vessels of not more than 1 000 L volume – Part 1: Design, fabrication, inspection and tests.	Until further notice

iv) The following standards apply for the design, construction, and initial inspection and test of UN metal hydride storage systems, except that inspection requirements related to the conformity assessment system and approval must be in accordance with the Technical Instructions:

Reference	*Title*	*Applicable for manufacture*
ISO 16111:2008	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride.	Until 31 December 2026
ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride.	Until further notice

V) The following standards apply for the design, construction and initial inspection and test of UN cylinders for adsorbed gases except that the inspection requirements related to the conformity assessment system and approval must be in accordance with the Technical Instructions.

Reference	*Title*	*Applicable for manufacture*
ISO 11513:2011	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection.	Until 31 December 2026
ISO 11513:2019	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection.	Until further notice
ISO 9809-1:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.	Until 31 December 2026
ISO 9809-1:2019	Gas cylinders – Design, construction and testing of refillable seamless steel gas cylinders and tubes – Part 1: Quenched and tempered steel cylinders and tubes with tensile strength less than 1 100 MPa.	Until further notice

vi) The following standards apply for the design, construction and initial inspection and test of non-refillable UN cylinders

Reference	*Title*	*Applicable for manufacture*
ISO 11118:1999	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods.	Until 31 December 2020
ISO 13340:2001	Transportable gas cylinders – Cylinder valves for non-refillable cylinders – Specification and prototype testing.	Until 31 December 2020
ISO 11118:2015	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods.	Until 31 December 2026
ISO 11118:2015 + Amd 1:2019	Gas cylinders – Non-refillable metallic gas cylinders – Specification and test methods.	Until further notice

b) Materials

In addition to the material requirements specified in the design and construction standards, and any restrictions specified in the applicable Packing Instruction for the gas(es) to be transported (such as

Packing Instruction 200, Packing Instruction 202 or Packing Instruction 214), the following standards apply to material compatibility:

Reference	*Title*	*Applicable for manufacture*
ISO 11114-1:2020	Gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 1: Metallic materials.	Until further notice
ISO 11114-2:2021	Gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 2: Non-metallic materials.	Until further notice

c) Closures and their protection

Reference	*Title*	*Applicable for manufacture*
ISO 11117:1998	Gas cylinders – Valve protection caps and valve guards for industrial and medical gas cylinders – Design, construction and tests.	Until 31 December 2014
ISO 11117:2008 + Cor 1:2009	Gas cylinders – Valve protection caps and valve guards – Design, construction and tests.	Until 31 December 2026
ISO 11117:2019	Gas cylinders – Valve protection caps and guards – Design, construction and tests.	Until further notice
ISO 10297:1999	Gas cylinders – Refillable gas cylinder valves – Specification and type testing.	Until 31 December 2008
ISO 10297:2006	Gas cylinders – Refillable gas cylinder valves – Specification and type testing.	Until 31 December 2020
ISO 10297:2014	Gas cylinders – Cylinder valves – Specification and type testing	Until 31 December 2022
ISO 10297:2014 + Amd 1:2017	Gas cylinders – Cylinder valves – Specification and type testing	Until further notice
ISO 14246:2014	Gas cylinders – Cylinder valves – Manufacturing tests and examination	Until 31 December 2024
ISO 14246:2014 + Amd 1:2017	Gas cylinders – Cylinder valves – Manufacturing tests and examination	Until further notice
ISO 17871:2015	Gas cylinders – Quick-release cylinders valves – Specification and type testing *Note.— This standard must not be used for flammable gases.*	Until 31 December 2026
ISO 17871:2020	Gas cylinders – Quick-release cylinder valves – Specification and type testing.	Until further notice
ISO 17879:2017	Gas cylinders – Self-closing cylinder valves – Specification and type testing *Note.— This standard must not be applied to self-closing valves in acetylene cylinders.*	Until further notice
ISO 23826:2021	Gas cylinders – Ball valves – Specification and testing	Until further notice

For UN metal hydride storage systems, the requirements specified in the following standard apply to closures and their protection:

Reference	*Title*	*Applicable for manufacture*
ISO 16111:2008	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Until 31 December 2026
ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride.	Until further notice

d) Periodic inspection and test

i) The following standards apply to the periodic inspection and testing of UN cylinders:

Reference	*Title*	*Applicable for manufacture*
ISO 6406:2005	Seamless steel gas cylinders – Periodic inspection and testing.	Until 31 December 2024
ISO 18119:2018	Gas cylinders – Seamless steel and seamless aluminium-alloy gas cylinders and tubes – Periodic inspection and testing.	Until 31 December 2026
ISO 18119:2018 + Amd 1:2021	Gas cylinders – Seamless steel and seamless aluminium-alloy gas cylinders and tubes – Periodic inspection and testing.	Until further notice
ISO 10460:2005	Gas cylinders – Welded carbon-steel gas cylinders – Periodic inspection and testing. *Note.— The repair of welds described in clause 12.1 of this standard must not be permitted. Repairs described in clause 12.2 require the approval of the appropriate national authority which approved the periodic inspection and test body.*	Until 31 December 2024
ISO 10460:2018	Gas cylinders – Welded aluminium-alloy, carbon and stainless steel gas cylinders – Periodic inspection and testing.	Until further notice
ISO 10461:2005 + Amd 1:2006	Seamless aluminium-alloy gas cylinders – Periodic inspection and testing.	Until 31 December 2024

ISO 10462:2013	Gas cylinders – Acetylene cylinders – Periodic inspection and maintenance.	Until 31 December 2024
Reference	*Title*	*Applicable for manufacture*
ISO 10462:2013 + Amd1:2019	Gas cylinders – Acetylene cylinders – Periodic inspection and maintenance.	Until further notice
ISO 11513:2011	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection.	Until 31 December 2024
ISO 11513:2019	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection.	Until further notice
ISO 11623:2015	Gas cylinders – Composite construction – Periodic inspection and testing	Until further notice
ISO 22434:2006	Transportable gas cylinders – Inspection and maintenance of cylinder valves *Note.— These requirements may be met at times other than at the periodic inspection and test of UN cylinders.*	Until further notice
ISO 20475:2018	Gas cylinders – Cylinder bundles – Periodic inspection and testing	Until further notice
ISO 23088:2020	Gas cylinders – Periodic inspection and testing of welded steel pressure drums – Capacities up to 1 000 L.	Until further notice

ii) The following standard applies to the periodic inspection and testing of UN metal hydride storage systems.

Reference	*Title*	*Applicable for manufacture*
ISO 16111:2008	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	Until 31 December 2024
ISO 16111:2018	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride.	Until further notice

e) Conformity assessment system and approval for manufacture of cylinders and closed cryogenic receptacles

i)General

1. Definitions

For the purposes of this section:

Conformity assessment system: a system for appropriate national authority approval of a manufacturer, by cylinder and closed cryogenic receptacle design type approval, approval of manufacturer's quality system and approval of inspection bodies.

Design type: a cylinder and closed cryogenic receptacle design as specified by a particular cylinder and closed cryogenic receptacle standard.

Verify: confirm by examination or provision of objective evidence that specified requirements have been fulfilled.

2. The requirements must be used for the conformity assessments of cylinders and closed cryogenic receptacles. However, the requirements may be replaced by requirements specified by the competent authority in the following cases:

- conformity assessment of closures;
- Not used; and
- conformity assessment of the complete assembly of closed cryogenic receptacles provided the inner vessel has been conformity assessed in accordance with the requirements.

ii) General requirements

1. Appropriate national authority

- The appropriate national authority that approves the cylinder and closed cryogenic receptacle must approve the conformity assessment system for the purpose of ensuring that cylinders and closed cryogenic receptacles conform to the requirements of these standards. In instances where the appropriate national authority that approves a cylinder and closed cryogenic receptacle is not the appropriate national authority in the country of manufacture, the marks of the approval country and the country of manufacture must be indicated in the cylinder and closed cryogenic receptacle marks (see 5.2.7 and 5.2.8). The appropriate national authority of the country of approval must supply to its counterpart in a country of use, upon request, evidence demonstrating compliance to this conformity assessment system.
- The appropriate national authority may delegate its conformity assessment system functions in whole or in part.
- The appropriate national authority must ensure that a current list of approved inspection bodies and their identity marks and approved manufacturers and their identity marks is available.

- Inspection body
- The inspection body must be approved by the appropriate national authority for the inspection of cylinders and closed cryogenic receptacles and must:

  a) have a staff with an organizational structure, capable, trained, competent and skilled, to satisfactorily perform its technical functions;
  b) have access to suitable and adequate facilities and equipment;
  c) operate in an impartial manner and be free from any influence which could prevent it from doing so;
  d) ensure commercial confidentiality of the commercial and proprietary activities of the manufacturer and other bodies;
  e) maintain clear demarcation between actual inspection body functions and unrelated functions;
  f) operate a documented quality system;
  g) ensure that the tests and inspections specified in the relevant cylinder and closed cryogenic receptacle standard and these standards are performed; and
  h) maintain an effective and appropriate report and record system

- Manufacturer

The manufacturer must:

a) operate a documented quality system;
b) apply for design type approvals
c) select an inspection body from the list of approved inspection bodies maintained by the appropriate national authority in the country of approval; and
d) maintain records

- Testing laboratory

The testing laboratory must have:

a) staff with an organizational structure, sufficient in number, competence and skill; and
b) suitable and adequate facilities and equipment to perform, to the satisfaction of the inspection body, the tests required by the manufacturing standard.

iii) Manufacturer's quality system

- The quality system must contain all the elements, requirements and provisions adopted by the manufacturer. It must be documented in a systematic and orderly manner in the form of written policies, procedures and standards.

  The contents must in particular include adequate descriptions of:

  a) the organizational structure and responsibilities of personnel with regard to design and product quality;

b) the design control and design verification techniques, processes and procedures that will be used when designing the cylinders and closed cryogenic receptacles;
c) the relevant cylinder and closed cryogenic receptacle manufacturing, quality control, quality assurance, and process operation standards that will be used;
d) quality records, such as inspection reports, test data and calibration data;
e) management reviews to ensure the effective operation of the quality system arising from the audits;
f) the process describing how customer requirements are met;
g) the process for control of documents and their revision;
h) the means for control of non-conforming cylinders and closed cryogenic receptacles, purchased components, in-process and final materials; and
i) training programmes and qualification procedures for relevant personnel.

iv) Approval Process

- Initial design type approval

The initial design type approval must consist of the approval of the manufacturer's quality system and the approval of the cylinder and closed cryogenic receptacle design to be produced. An application for an initial design type approval must meet the requirements.

- A manufacturer desiring to produce cylinders and closed cryogenic receptacles in accordance with a cylinder and closed cryogenic receptacle standard and these standards must apply for, obtain and retain a Design Type Approval Certificate issued by the appropriate national authority in the country of approval for at least one cylinder and closed cryogenic receptacle design type in accordance with the required procedure. This certificate must, on request, be submitted to the appropriate national authority of the country of use.
- An application must be made for each manufacturing facility and must include:

a) the name and registered address of the manufacturer and, in addition, if the application is submitted by an authorized representative, its name and address;
b) the address of the manufacturing facility (if different from the above);
c) the name and title of the person(s) responsible for the quality system;
d) the designation of the cylinder and closed cryogenic receptacle and the relevant cylinder and closed cryogenic receptacle standard;
e) details of any refusal of approval of a similar application by any other appropriate national authority;
f) the identity of the inspection body for design type approval;
g) documentation on the manufacturing facility
h) the technical documentation required for design type approval, which must enable verification of the conformity of the cylinders and closed cryogenic receptacles with the

requirements of the relevant cylinder and closed cryogenic receptacle design standard. The technical documentation must cover the design and method of manufacture and must contain, as far as is relevant for assessment, at least the following:

- cylinder and closed cryogenic receptacle design standard, design and manufacturing drawings, showing components and sub-assemblies, if any;
- descriptions and explanations necessary for the understanding of the drawings and intended use of the cylinders and closed cryogenic receptacles;
- a list of the standards necessary to fully define the manufacturing process;
- design calculations and material specifications; and
- design type approval test reports, describing the results of examinations and tests

f) Approval system for periodic inspection and test of cylinders and closed cryogenic receptacles

i)Definitions

Approval system for periodic inspection and test of cylinders and closed cryogenic receptacles

For the purposes of this section:

Approval system: means a system for the appropriate national authority approval of a body performing the periodic inspection and test of cylinders and closed cryogenic receptacles (hereinafter referred to as “periodic inspection and test body”), including approval of that body’s quality system.

ii) General requirements

- Appropriate national authority

  The appropriate national authority must establish an approval system for the purpose of ensuring that the periodic inspection and test of cylinders and closed cryogenic receptacles conform to the requirements of these standards. In instances where the appropriate national authority that approves the body performing periodic inspection and test of a cylinder and closed cryogenic receptacle is not the appropriate national authority of the country approving the manufacture of the cylinder, the marks of the approval country of periodic inspection and test must be indicated in the cylinder and closed cryogenic receptacle marks.

- The appropriate national authority of the country of approval for the periodic inspection and test must supply, upon request, evidence demonstrating compliance with this approval system, including the records of the periodic inspection and test, to its counterpart in a country of use.
- The appropriate national authority of the country of approval may terminate the approval certificate upon evidence demonstrating non-compliance with the approval system.
- The appropriate national authority may delegate its functions in this approval system, in whole or in part.

- The appropriate national authority must ensure that a current list of approved periodic inspection and test bodies and their identity marks is available.
- Periodic inspection and test body

The periodic inspection and test body must be approved by the appropriate national authority and must:

a) have a staff with an organizational structure, capable, trained, competent and skilled to satisfactorily perform its technical functions;
b) have access to suitable and adequate facilities and equipment;
c) operate in an impartial manner and be free from any influence that could prevent it from doing so;
d) ensure commercial confidentiality;
e) maintain clear demarcation between actual periodic inspection and test body functions and unrelated functions;
f) operate a documented quality system
g) apply for approval in accordance with
h) ensure that the periodic inspections and tests are performed in and
i) maintain an effective and appropriate report and record system

iii) Quality system and audit of the periodic inspection and test body

Quality system

- The quality system must contain all the elements, requirements and provisions adopted by the periodic inspection and test body. It must be documented in a systematic and orderly manner in the form of written policies, procedures and standards.
- The quality system must include:
  a) a description of the organizational structure and responsibilities;
  b) the relevant inspection and test, quality control, quality assurance and process operation standards that will be used;
  c) quality records, such as inspection reports, test data, calibration data and certificates;
  d) management reviews to ensure the effective operation of the quality system arising from the audits performed;
  e) a process for control of documents and their revision;
  f) a means for control of non-conforming cylinders and closed cryogenic receptacles; and training programmes and qualification procedures for relevant personnel.

g) Marking of UN refillable cylinders and closed cryogenic receptacles

i)Refillable UN cylinder shells and closed cryogenic receptacles must be marked clearly and legibly with certification, operational and manufacturing marks. These marks must be permanently affixed (such as stamped, engraved or etched). The marks must be on the shoulder, top end or neck of the cylinder shell and closed cryogenic receptacle or on a permanently affixed component of the cylinder shell and closed cryogenic receptacle (such as welded collar or corrosion-resistant plate welded to the outer jacket of a closed cryogenic receptacle). Except for the UN packaging symbol, the minimum size

of the marks must be 5 mm for cylinders and closed cryogenic receptacles with a diameter greater than or equal to 140 mm and 2.5 mm for cylinders and closed cryogenic receptacles with a diameter less than 140 mm. The minimum size of the UN packaging symbol must be 10 mm for cylinders and closed cryogenic receptacles with a diameter greater than or equal to 140 mm and 5 mm for cylinders and closed cryogenic receptacles with a diameter less than 140 mm.

ii) The following certification marks must be applied:

- The UN packaging symbol

- This symbol must not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Chapters 1 to 6;
- The technical standard (such as ISO 9809-1) used for the design, construction and testing and, for acetylene cylinders, the standard ISO 3807.
- The character(s) identifying the country of approval, as indicated by the distinguishing signs used on vehicles in international road traffic;

Note 1.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

Note 2.— For the purpose of this mark the State of approval means the State of the appropriate national authority that authorized the initial inspection and test of the individual receptacle at the time of manufacture.

- The identity mark or stamp of the inspection body that is registered with the appropriate national authority of the country authorizing the marking;
- The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (that is, “/”).

iii) The following operational marks must be applied:

- The test pressure in bar, preceded by the letters “PH” and followed by the letters “BAR”;
- The mass of the empty cylinder and closed cryogenic receptacle including all permanently attached integral parts (such as neck ring, foot ring, etc.) in kilograms, followed by the letters “KG”. This mass must not include the mass of closure(s), valve protection cap or valve guard, any coating, or porous mass for acetylene. The mass must be expressed to three significant figures rounded up to the last digit. For cylinders and closed cryogenic receptacles of less than 1 kg, the mass must be expressed to two significant figures rounded up to the last digit. In the case of cylinders for UN 1001 Acetylene, dissolved and UN 3374 Acetylene, solvent free, at

least one decimal must be shown after the decimal point and two digits for cylinders of less than 1 kg;

- The minimum guaranteed wall thickness of the cylinder in millimetres followed by the letters "MM". This mark is not required for cylinders with a water capacity less than or equal to 1 litre or for composite cylinders or for closed cryogenic receptacles;
- In the case of cylinders for compressed gases, UN 1001 Acetylene, dissolved, and UN 3374 Acetylene, solvent free, the working pressure in bar, preceded by the letters "PW". In the case of closed cryogenic receptacles, the maximum allowable working pressure preceded by the letters "MAWP";

Note.— When a cylinder shell is intended for use as an acetylene cylinder (including the porous material), the working pressure mark is not required until the acetylene cylinder is completed.

- In the case of cylinders for liquefied gases and dissolved gases and closed cryogenic receptacles, the water capacity in litres expressed to three significant figures rounded down to the last digit, followed by the letter "L". If the value of the minimum or nominal water capacity is an integer, the digits after the decimal point may be neglected;
- In the case of cylinders for UN 1001 Acetylene, dissolved:

- ✓ the tare in kilograms consisting of the total of the mass of the empty cylinder shell, the service equipment (including porous material) not removed during filling, any coating, the solvent and the saturation gas expressed to three significant figures rounded down to the last digit followed by the letters "KG". At least one decimal must be shown after the decimal point. For cylinders of less than 1 kg, the mass must be expressed to two significant figures rounded down to the last digit;
- ✓ the identity of the porous material (such as name or trademark); and
- ✓ the total mass of the filled acetylene cylinder in kilograms followed by the letters "KG";
- ✓ In the case of cylinders for UN 3374 Acetylene, solvent free:

i) the tare in kilograms consisting of the total of the mass of the empty cylinder shell, the service equipment (including porous material) not removed during filling and any coating expressed to three significant figures rounded down to the last digit followed by the letters "KG". At least one decimal must be shown after the decimal point. For cylinders of less than 1 kg, the mass must be expressed to two significant figures rounded down to the last digit;

ii) the identity of the porous material (such as name or trademark); and

iii) the total mass of the filled acetylene cylinder in kilograms followed by the letters "KG".

+ Note.— Acetylene cylinders constructed in accordance with the 2021–2022 edition of these standards, which are not marked in accordance with the requirements applicable in the 2023–2024 edition of these In standards, may continue to be used until the next periodic inspection and test two years after the coming into force of this edition of these standards, where they must be marked according to the provisions above or be taken out of operation.

iv)The following manufacturing marks must be applied

- ✓ Identification of the cylinder thread (such as 25E). This mark is not required for closed cryogenic receptacles;

Note.— Information on marks that may be used for identifying threads for cylinders is given in ISO/TR 11364, Gas cylinders – Compilation of national and international valve stem/gas cylinder neck threads and their identification and marking system.

- ✓ The manufacturer's mark registered by the appropriate national authority. When the country of manufacture is not the same as the country of approval, then the manufacturer's mark must be preceded by the character(s) identifying the country of manufacture, as indicated by the distinguishing signs used on vehicles in international road traffic. The country mark and the manufacturer's mark must be separated by a space or slash;

Note 1.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

Note 2.— For acetylene cylinders, if the manufacturer of the acetylene cylinder and the manufacturer of the cylinder shell are different, only the mark of the manufacturer of the completed acetylene cylinder is required.

- ✓ The serial number assigned by the manufacturer;
- ✓ In the case of steel cylinders and closed cryogenic receptacles and composite cylinders and closed cryogenic receptacles with steel liner intended for the transport of gases with a risk of hydrogen embrittlement, the letter "H" showing compatibility of the steel (see ISO 11114-1:2020);
- ✓ For composite cylinders having a limited design life, the letters "FINAL" followed by the design life shown as the year (four digits) followed by the month (two digits) separated by a slash (that is, "/");
- ✓ For composite cylinders having a limited design life greater than fifteen years and for composite cylinders and tubes having non-limited design life, the letters "SERVICE" followed by the date fifteen years from the date of manufacture (initial inspection) shown as the year (four digits) followed by the month (two digits) separated by a slash (that is, "/").

Note.— Once the initial design type has passed the service life test programme requirements, future production no longer requires this initial service life mark. The initial service life mark must be made unreadable on cylinders of a design type that has met the service life test programme requirements.

v) Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. In the case of closed cryogenic receptacles, such marks may be on a separate plate attached to the outer jacket. Such marks must not conflict with required marks.

vi) In addition to the preceding marks, each refillable cylinder and closed cryogenic receptacle that meets the periodic inspection and test requirements specified must be marked indicating:

- the character(s) identifying the country authorizing the body performing the periodic inspection and test as indicated by the distinguishing sign used on vehicles in international road traffic. This mark is not required if this body is approved by the appropriate national authority of the country approving manufacture;
- the registered mark of the body authorized by the appropriate national authority for performing the periodic inspection and test;
- the date of the periodic inspection and test, the year (two digits) followed by the month (two digits) separated by a slash (that is, ”/”). Four digits may be used to indicate the year.

The above marks must appear consecutively in the sequence given.

vii) The marks in accordance with vi) may be engraved on a metallic ring affixed to the cylinder when the valve is installed and which is removable only by disconnecting the valve from the cylinder.

h) Marking of non-refillable UN cylinders

i) Non-refillable UN cylinders must be marked clearly and legibly with certification and gas or cylinder specific marks. These marks must be permanently affixed (such as stencilled, stamped, engraved or etched) on the cylinder. Except when stencilled, the marks must be on the shoulder, top end or neck of the cylinder shell or on a permanently affixed component of the cylinder (such as welded collar). Except for the “UN” mark and the “DO NOT REFILL” mark, the minimum size of the marks must be 5 mm for cylinders with a diameter greater than or equal to 140 mm and 2.5 mm and for cylinders with a diameter less than 140 mm. The minimum size of the “UN” mark must be 10 mm for cylinders with a diameter greater than or equal to 140 mm and 5 mm for cylinders with a diameter less than 140 mm. The minimum size of the “DO NOT REFILL” mark must be 5 mm.

ii) The marks listed as required must be applied with the exceptions as specified. The serial number o) may be replaced by the batch number. In addition, the words “DO NOT REFILL” in letters of at least 5 mm in height are required.

iii) The requirements specified must apply.

Note.— Non-refillable cylinders may, on account of their size, substitute a label for these permanent marks.

iv) Other marks are allowed provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks must not conflict with required marks.

i) Marking of UN metal hydride storage systems

i) UN metal hydride storage systems must be marked clearly and legibly with the marks listed in ii) These marks must be permanently affixed (such as stamped, engraved, or etched) on the metal hydride storage system. The marks must be on the shoulder, top end or neck of the metal hydride storage system or on a permanently affixed component of the metal hydride storage system. Except for the United Nations packaging symbol, the minimum size of the marks must be:

— 5 mm for metal hydride storage systems with a smallest overall dimension greater than or equal to 140 mm; and
— 2.5 mm for metal hydride storage systems with a smallest overall dimension less than 140 mm. The minimum size of the United Nations packaging symbol must be:
— 10 mm for metal hydride storage systems with a smallest overall dimension greater than or equal to 140 mm; and
— 5 mm for metal hydride storage systems with a smallest overall dimension less than 140 mm.

ii) The following marks must be applied:

- The UN packaging symbol

This symbol must not be used for any purpose other than for certifying that a packaging complies with the relevant requirements throughout Segment 6;

- "ISO 16111" (the technical standard used for design, manufacture and testing);
- The character(s) identifying the country of approval, as indicated by the distinguishing signs used on vehicles in international road traffic;

Note 1.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

Note 2.— For the purpose of this mark the State of approval means the State of the appropriate national authority that authorized the initial inspection and test of the individual system at the time of manufacture.

- The identity mark or stamp of the inspection body that is registered with the appropriate national authority of the country authorizing the marking;
- The date of the initial inspection, the year (four digits), followed by the month (two digits) and separated by a slash (that is, "/");
- The test pressure of the cylinder in bar, preceded by the letters "PH" and followed by the letters "BAR";
- The rated charging pressure of the metal hydride storage system in bar, preceded by the letters "RCP" and followed by the letters "BAR";

- The manufacturer's mark registered by the appropriate national authority. When the country of manufacture is not the same as the country of approval, then the manufacturer's mark must be preceded by the character(s) identifying the country of manufacture, as indicated by the distinguishing signs used on vehicles in international road traffic. The country mark and the manufacturer's mark must be separated by a space or slash;

Note.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

- The serial number assigned by the manufacturer;
- In the case of steel cylinders and composite cylinders with steel liner, the letter "H" showing compatibility of the steel (see 1SO 11114-1:2020); and
- In the case of metal hydride storage systems having limited life, the date of expiry, denoted by the letters "FINAL" followed by the year (four digits), followed by the month (two digits) and separated by a slash (that is, "/").

The certification marks specified above must appear consecutively in the sequence given. The test pressure must be immediately preceded by the rated charging pressure.

iii) Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. Such marks must not conflict with required marks.

iv)In addition to the preceding marks, each metal hydride storage system that meets the periodic inspection and the required test requirements must be marked indicating:

- the character(s) identifying the country authorizing the body performing the periodic inspection and test, as indicated by the distinguishing sign used on vehicles in international road traffic. This mark is not required if this body is approved by the appropriate national authority of the country approving manufacture;

Note.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

- the registered mark of the body authorized by the appropriate national authority for performing periodic inspection and test;
- the date of the periodic inspection and test, the year (two digits), followed by the month (two digits) and separated by a slash (that is, "/"). Four digits may be used to indicate the year.

The above marks must appear consecutively in the sequence given.

j) Marking of closures for refillable UN cylinders and closed cryogenic receptacles

i) For closures, the following permanent marks must be applied clearly and legibly (such as stamped, engraved or etched):

- manufacturer's identification mark;
- design standard or design standard designation;
- date of manufacture (year and month or year and week); and
- the identity mark of the inspection body responsible for the initial inspection and test, if applicable.

k) The valve test pressure must be marked when it is less than the test pressure which is indicated by the rating of the valve filling connection.

3) REQUIREMENTS FOR NON-UN CYLINDERS AND NON-UN CLOSED CRYOGENIC RECEPTACLES

a) Cylinders and closed cryogenic receptacles not designed, constructed, inspected, tested and approved according to the requirements of 5.2 must be designed, constructed, inspected, tested and approved in accordance with the provisions of a technical code recognized by the appropriate national authority and the general requirements of 1)

b) Cylinders and closed cryogenic receptacles designed, constructed, inspected, tested and approved under the provisions of this section must not be marked with the UN packaging symbol.

c) For metallic cylinders, the construction must be such that the minimum burst ratio (burst pressure divided by test pressure) is:
1.50 for refillable cylinders,
2.00 for non-refillable cylinders.
Marking must be in accordance with the requirements of the appropriate national authority of the country of use.

4) REQUIREMENTS FOR AEROSOL DISPENSERS, SMALL RECEPTACLES CONTAINING GAS (GAS CARTRIDGES) AND FUEL CELL CARTRIDGES CONTAINING LIQUEFIED FLAMMABLE GAS

a) The internal pressure of aerosol dispensers at 50°C must not exceed 1.2 MPa (12 bar) when using flammable liquefied gases, 1.32 MPa (13.2 bar) when using non-flammable liquefied gases, and 1.5 MPa (15 bar) when using non-flammable compressed or dissolved gases. In case of a mixture of several gases, the stricter limit applies.
b) For aerosol dispensers, the liquid content must not completely fill the closed receptacle at 55°C.
c) The capacity of metal receptacles must not exceed 1 000 mL; plastics receptacles must not exceed

500 mL.
d) Each model of receptacles (aerosol dispensers or cartridges) must, before being put into service, satisfy a hydraulic pressure test.
e) The internal pressure to be applied (test pressure) must be 1.5 times the internal pressure at 50°C, with a minimum pressure of 1 MPa (10 bar).
f) The hydraulic pressure tests must be carried out on at least five empty receptacles of each model:

i) until the prescribed test pressure is reached, by which time no leakage or visible permanent deformation must have occurred; and
ii) until leakage or bursting occurs; the dished end, if any, must yield first and the receptacle must not leak or burst until a pressure 1.2 times the test pressure has been reached or passed.

iii) Each filled aerosol dispenser or gas cartridge or fuel cell cartridge must be subjected to a test in a hot water bath.

iv)The temperature of the water bath and the duration of the test must be such that the internal pressure reaches that which would be reached at 55 ° C (50 ° C if the liquid phase does not exceed 95 per cent of the capacity of the aerosol dispenser, gas cartridge or fuel cell cartridge at 50 ° C). If the contents are sensitive to heat or if the aerosol dispensers, gas cartridges or fuel cell cartridges are made of plastics material which softens at this test temperature, the temperature of the bath must be set at between 20 ° C and 30 ° C but, in addition, one aerosol dispenser, gas cartridge or fuel cell cartridge in 2 000 must be tested at the higher temperature.

v)No leakage or permanent deformation of an aerosol dispenser, gas cartridge or fuel cell cartridge may occur, except that a plastic aerosol dispenser, gas cartridge or fuel cell cartridge may be deformed through softening provided that it does not leak.

Quality system

- Aerosol dispenser, gas cartridge or fuel cell cartridge fillers and component manufacturers must have a quality system. The quality system must implement procedures to ensure that all aerosol dispensers, gas cartridges or fuel cell cartridges that leak or that are deformed are rejected and not offered for transport.
- The quality system must include:
    a. a description of the organizational structure and responsibilities;
    b. the relevant inspection and test, quality control, quality assurance, and process operation standards that will be used;
    c. quality records, such as inspection reports, test data, calibration data and certificates;
    d. management reviews to ensure the effective operation of the quality system;
    e. a process for control of documents and their revision;
    f. a means for control of non-conforming aerosol dispensers, gas cartridges or fuel cell cartridges;
    g. training programmes and qualification procedures for relevant personnel; and
    h. procedures to ensure that there is no damage to the final product.

- An initial audit and periodic audits must be conducted to the satisfaction of the appropriate national authority. These audits must ensure the approved system is and remains adequate

and efficient. Any proposed changes to the approved system must be notified to the appropriate national authority in advance.

Aerosol dispensers

- Pressure and leak testing of aerosol dispensers before filling

Each empty aerosol dispenser must be subjected to a pressure equal to or in excess of the maximum expected in the filled aerosol dispensers at 55□C (50□C if the liquid phase does notexceed 95 percent of the capacity of the receptacle at 50□C). This must be at least two-thirds of the design pressure of the aerosol dispenser. If any aerosol dispenser shows evidence of leakage at a rate equal to or greater than 3.3 □ 10-2 mbar.l.s-1 at the test pressure, distortion or other defect, it must be rejected.

- Testing of the aerosol dispensers after filling
- Prior to filling, the filler must ensure that the crimping equipment is set appropriately and the specified propellant is used.
- Each filled aerosol dispenser must be weighed and leak tested. The leak detection equipment must be sufficiently sensitive to detect at least a leak rate of 2.0 □ 10-3 mbar.l.s-1 at 20□C.
- Any filled aerosol dispenser which shows evidence of leakage, deformation or excessive mass must be rejected.

vi) Gas cartridges and fuel cell cartridges

- Pressure testing of gas cartridges and fuel cell cartridges
- Each gas cartridge or fuel cell cartridge must be subjected to a test pressure equal to or in excess of the maximum expected in the filled receptacle at 55°C (50°C if the liquid phase does not exceed 95 per cent of the capacity of the receptacle at 50°C). This test pressure must be that specified for the gas cartridge or fuel cell cartridge and must not be less than two thirds the design pressure of the gas cartridge or fuel cell cartridge. If any gas cartridge or fuel cell cartridge shows evidence of leakage at a rate equal to or greater than 3.3 x 10-2 mbar.l.s-1 at the test pressure, distortion or any other defect, it must be rejected.
- Leak testing gas cartridges and fuel cell cartridges
- Prior to filling and sealing, the filler must ensure that the closures (if any) and the associated sealing equipment are closed appropriately and the specified gas is used.
- Each filled gas cartridge or fuel cell cartridge must be checked for the correct mass of gas and must be leak tested. The leak detection equipment must be sufficiently sensitive to detect at least a leak rate of 2.0 x 10-3 mbar.l.s-1 at 20°C.
- Any gas cartridge or fuel cell cartridge that has a gas mass not in conformity with the declared mass limits or shows evidence of leakage or deformation, must be rejected.

vii) With the approval of the appropriate national authority, aerosols and receptacles, small, are not subject to above if they are required to be sterile, but may be adversely affected by water bath testing, provided:

- they contain a non-flammable gas and either:
- contain other substances that are constituent parts of pharmaceutical products for medical, veterinary or similar purposes; or

- contain other substances used in the production process for pharmaceutical products; or
  - are used in medical, veterinary or similar applications;
  - an equivalent level of safety is achieved by the manufacturer's use of alternative methods for leak detection and pressure resistance, such as helium detection and water bathing using a statistical sample of at least 1 in 2 000 from each production batch; and

  - for pharmaceutical products according to a) i) and iii) above, they are manufactured under the authority of a national health administration. If required by the appropriate national authority, the principles of Good Manufacturing Practice (GMP) established by the World Health Organization (WHO)1 must be followed.

5. PACKAGINGS FOR INFECTIOUS SUBSTANCES OF CATEGORY A (UN 2814 AND UN 2900)

1) GENERAL

The requirements of this chapter apply to packagings intended for the transport of infectious substances of Category A, UN 2814 and UN 2900.

2) REQUIREMENTS FOR PACKAGINGS

a) The requirements for packagings in this section are based on packagings, as specified in Chapter 2, currently used. In order to take into account progress in science and technology, there is no objection to the use of packagings having specifications different from those in this chapter provided that they are equally effective, acceptable to the competent authority and able to successfully fulfil the requirements described in 6.5. Methods of testing other than those described in these standards are acceptable provided they are equivalent.

b) Packagings must be manufactured and tested under a quality assurance programme which satisfies the competent authority in order to ensure that each packaging meets the requirements of this chapter.

Note.— ISO 16106:2020 Transport packages for dangerous goods – Dangerous goods packagings, intermediate bulk containers (IBCs) and large packagings – Guidelines for the application of ISO 9001 provides acceptable guidance on procedures that may be followed.

c)Manufacturers and subsequent distributors of packagings must provide information regarding procedures to be followed (including closure standards for inner packagings and receptacles), a description of the types and dimensions of the closures (including required gaskets) and any other components needed to ensure that packages, as presented for transport, are capable of passing the applicable performance tests of this chapter.

3) CODE FOR DESIGNATING TYPES OF PACKAGINGS

a) The codes for designating types of packagings are set out in below.

b) The letters “U” or “W” may follow the packaging code. The letter “U” signifies a special packaging. The letter “W” signifies that the packaging, although of the same type indicated by the code, is manufactured to a specification different from that in Chapter 3.

4) MARKING

.— The marks indicate that the packaging which bears them corresponds to a successfully tested design type and that it complies with the provisions of this chapter which are related to the manufacture, but not to the use, of the packaging.

Note 2.— The marks are intended to be of assistance to packaging manufacturers, reconditioners, packaging users, operators and appropriate authorities.

Note 3.— The marks do not always provide full details of the test levels, etc., and these may need to be taken further into account, such as by reference to a test certificate, test reports or register of successfully tested packagings.

a. Each packaging intended for use according to these standards must bear marks which are durable, legible and placed in a location and of such a size relative to the packaging as to be readily visible. For packages with a gross mass of more than 30 kg the marks, or a duplicate thereof, must appear on the top or on a side of the packaging. Letters, numerals and symbols

must be at least 12 mm high, except for packagings of 30 L capacity or less or of 30 kg maximum net mass, when they must be at least 6 mm in height and except for packagings of 5 L capacity or less or of 5 kg maximum net mass, when they must be of an appropriate size.

b. A packaging that meets the requirements of this section and of 6.5 shall be marked with:

i)the United Nations packaging symbol;

This symbol must not be used for any purpose other than certifying that a packaging complies with the relevant requirements in Chapters 1 to 6;

a) the code designating the type of packaging according to the requirements of above the text "CLASS 6.2";

i)the last two digits of the year of manufacture of the packaging;

ii)the State authorizing the allocation of the mark, indicated by the distinguishing sign used on vehicles in international road traffic;

Note.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

I. the name of the manufacturer or other identification of the packaging specified by the competent authority; and
II. for packagings meeting the requirements specified, the letter "U", inserted immediately following the mark required above.
III. Marks must be applied in the sequence required, each mark required in these sub-paragraphs must be clearly separated, such as by a slash or space, so as to be easily identified. Any additional markings authorized by a competent authority must still enable the marks required to be correctly identified.

5) TEST REQUIREMENTS FOR PACKAGINGS

a) Performance and frequency of tests

i) The design type of each packaging must be tested as provided for in this chapter in accordance with procedures established by the competent authority.

ii) Each packaging design type must successfully pass the tests prescribed in this chapter before being used. A packaging design type is defined by the design, size, material and thickness, manner of construction and packing, but may include various surface treatments. It also includes packagings which differ from the design type only in their lesser design height.

iii) Tests must be repeated on production samples at intervals established by the competent authority.

iv) Tests must also be repeated after each modification which alters the design, material or manner of construction of a packaging.

v) The competent authority may permit the selective testing of packagings that differ only in minor respects from a tested type, such as smaller sizes or lower net mass of primary receptacles; and packagings such as drums and boxes which are produced with small reductions in external dimension(s).

vi) Primary receptacles of any type may be assembled within a secondary packaging and transported without testing in the rigid outer packaging under the following conditions:

- The rigid outer packaging combination must have been successfully tested with fragile (such as glass) primary receptacles.

- The total combined gross mass of primary receptacles must not exceed one-half the gross mass of primary receptacles used for the drop test in a) above.

- The thickness of cushioning between primary receptacles and between primary receptacles and the outside of the secondary packaging must not be reduced below the corresponding thicknesses in the originally tested packaging; and if a single primary receptacle was used in the original test, the thickness of cushioning between primary receptacles must not be less than the thickness of cushioning between the outside of the secondary packaging and the primary receptacle in the original test. When either fewer or smaller primary receptacles are used (as compared to the primary receptacles used in the drop test), sufficient additional cushioning material must be used to take up the void spaces.

- The rigid outer packaging must have successfully passed the stacking test in 4.6 while empty. The total mass of identical packages must be based on the combined mass of packagings used in the drop test in a) above.

  For primary receptacles containing liquids, an adequate quantity of absorbent material to absorb the entire liquid content of the primary receptacles must be present.

- If the rigid outer packaging is intended to contain primary receptacles for liquids and is not leakproof, or is intended to contain primary receptacles for solids and is not siftproof, a means of containing any liquid or solid contents in the event of leakage must be provided in the form of a leakproof liner, plastic bag or other equally effective means of containment.

vii) The competent authority may at any time require proof, by tests in accordance with this chapter, that serially produced packagings meet the requirements of the design type tests.

viii) Provided the validity of the test results is not affected, and with the approval of the competent authority, several tests may be made on one sample.

b) Preparation of packagings for testing

i)Samples of each packaging must be prepared as for transport except that the liquid or solid infectious substance must be replaced by water or, where conditioning at –18°C is specified, by a water/antifreeze mixture. Each primary receptacle must be filled to not less than 98 per cent of its capacity.

Note.— The term water includes water/antifreeze solution with a minimum specific gravity of 0.95 for testing at –18°C.

ii) Tests and number of samples required

Table 6-4. Tests required for packaging types

Type of packaging[a]			*Tests required*					
	Primary receptacle		*Water spray*	*Cold conditioning*	*Drop*	*Additional drop*	*Puncture*	*Stacking*
Rigid outer packaging	*Plastics*	*Other*	*No. of samples*	*No. of samples*	*No. of samples*	*No. of samples*	*No. of samples*	*No. of samples*
Fibreboard box	X		5	5	10		2	
		X	5	0	5		2	
Fibreboard drum	X		3	3	6		2	
		X	3	0	3		2	
Plastics box	X		0	5	5	Required on one sample when the packaging is intended to contain dry ice.	2	Required on three samples when testing a “U”-marked packaging, as defined in 6.5.1.6 for specific provisions.
		X	0	5	5		2	
Plastics drum/ jerrican	X		0	3	3		2	
		X	0	3	3		2	
Boxes of other material	X		0	5	5		2	
		X	0	0	5		2	
Drums/	X		0	3	3		2	

jerricans of other material	X	0	0	3	2

a. *Type of packaging* categorizes packagings for test purposes according to the kind of packaging and its material characteristics.

Note 1.— In instances where a primary receptacle is made of two or more materials, the material most liable to damage determines the appropriate test.
Note 2.— The material of the secondary packagings are not taken into consideration when selecting the test or conditioning for the test.

Explanation for use of Table 6-4

- If the packaging to be tested consists of a fibreboard outer box with a plastics primary receptacle, five samples must undergo the water spray test prior to dropping and another five must be conditioned to –18°C prior to dropping. If the packaging is to contain dry ice, then one further single sample must be dropped.

- Packagings prepared as for transport must be subjected to the tests in. For outer packagings, the headings in Table 6-4 relate to fibreboard or similar materials whose performance may be rapidly affected by moisture, plastics which may embrittle at low temperature, and other materials such as metal whose performance is not affected by moisture or temperature.

c) Drop height and target

i)Samples must be subjected to free-fall drops from a height of 9 metres onto a non-resilient, horizontal, flat, massive and rigid surface.

ii) Number of test samples and drop orientation

iii) Where the samples are in the shape of a box, five must be dropped, one in each of the following orientations:

- flat on the base;
- flat on the top;
- flat on the longest side;
- flat on the shortest side;
- on a corner.

iv) Where the samples are in the shape of a drum or a jerrican, three must be dropped, one in each of the following orientations:

- diagonally on the top edge, with the centre of gravity directly above the point of impact;
- diagonally on the base edge;
- flat on the body or side.

v) While the sample must be released in the required orientation, it is accepted that for aerodynamic reasons the impact may not take place in that orientation.

vi) Following the appropriate drop sequence, there must be no leakage from the primary receptacle(s), which must remain protected by cushioning/absorbent material in the secondary packaging.

vii) Special preparation of test sample for the drop test

viii) Fibreboard – water spray test

Fibreboard outer packagings: The sample must be subjected to a water spray that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour

ix) Plastics material – cold conditioning
Plastics primary receptacles or outer packagings: The temperature of the test sample and its contents must be reduced to -18°C or lower for a period of at least 24 hours and within 15 minutes of removal from that atmosphere the test sample must be subjected to the required test. Where the sample contains dry ice, the conditioning period may be reduced to four hours.

d) Puncture Test

i) Packagings with a gross mass of 7 kg or less

Samples must be placed on a level, hard surface. A cylindrical steel rod with a mass of at least 7 kg, a diameter of 38 mm and the impact end edges of a radius not exceeding 6 mm (see Figure 6-1) must be dropped in a vertical free fall from a height of one metre measured from the impact end to the impact surface of the sample. One sample must be placed on its base. A second sample must be placed in an orientation perpendicular to that used for the first sample. In each instance, the steel rod must be aimed to impact the primary receptacle. Following each impact, penetration of the secondary packaging is acceptable, provided that there is no leakage from the primary receptacle(s).

ii) Packagings with a gross mass exceeding 7 kg

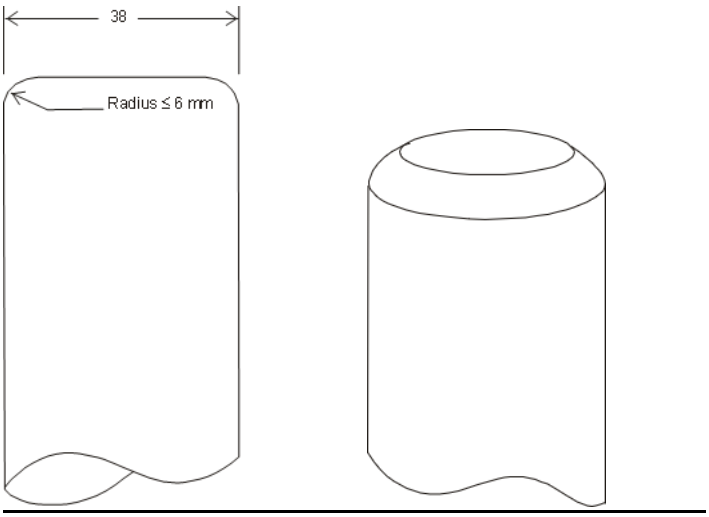
Samples are dropped onto the end of a cylindrical steel rod. The rod must be set vertically on a level, hard surface. It must have a diameter of 38 mm with the upper end edges of a radius not exceeding 6 mm (see Figure 6-1). The rod must protrude from the surface a distance at least equal to the distance between the centre of the primary receptacle(s) and the outer surface of the outer packaging, with a minimum protrusion of 200 mm. One sample is dropped with its top face lowermost in a vertical free fall from a height of 1 m, measured from the top of the steel rod. A second sample is dropped from the same height in an orientation perpendicular to that used for the first sample. In each instance, the packaging must be so orientated that the steel rod would be capable of penetrating the primary receptacle(s). Following each impact, penetration of the secondary packaging is acceptable provided that there is no leakage from the primary receptacle(s).

e) Test Report

i)A written test report containing at least the following particulars must be prepared and must be available to the users of the packaging:

- name and address of the test facility;
- name and address of the applicant (where appropriate);
- a unique test report identification;
- date of the test and of the report;
- manufacturer of the packaging;
- description of the packaging design type (such as dimensions, materials, closures, thickness, etc.), including method of manufacture (such as blow moulding) and which may include drawing(s) and/or photograph(s);
- maximum capacity;
- test contents;
- test descriptions and results;
- a signature and the name and status of the signatory.

ii) The test report must contain statements that the packaging prepared for transport was tested in accordance with the appropriate requirements of this chapter and that the use of other packaging methods or components may render it invalid. A copy of the test report must be available to the appropriate national authority.



Cylindrical steel rod used for puncture test

6. REQUIREMENTS FOR THE CONSTRUCTION, TESTING AND APPROVAL OF PACKAGES FOR RADIOACTIVE MATERIAL AND FOR THE APPROVAL OF SUCH MATERIAL

1) GENERAL REQUIREMENTS

i) The package must be so designed in relation to its mass, volume and shape that it can be easily and safely transported. In addition, the package must be so designed that it can be properly secured in the aircraft during transport.

ii) The design must be such that any lifting attachments on the package will not fail when used in the intended manner and that, if failure of the attachments should occur, the ability of the package to meet other requirements of these standards would not be impaired. The design must take account of appropriate safety factors to cover snatch lifting.

iii) Attachments and any other features on the outer surface of the package which could be used to lift it must be designed either to support its mass in accordance with the requirements or must be removable or otherwise rendered incapable of being used during transport.

iv) As far as practicable, the package must be designed so that the external surfaces are free from protruding features and can be easily decontaminated.

v) As far as practicable, the outer layer of the package must be designed so as to prevent the collection and the retention of water.

vi) Any features added to the package at the time of transport which are not part of the package must not reduce its safety.

vii) The package must be capable of withstanding the effects of any acceleration, vibration or vibration resonance, which may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the package as a whole. In particular, nuts, bolts and other securing devices must be designed so as to prevent them from becoming loose or being released unintentionally, even after repeated use.

viii) The design of the package must take into account ageing mechanisms.

ix) The materials of the packaging and any components or structures must be physically and chemically compatible with each other and with the radioactive contents. Account must be taken of their behaviour under irradiation.

x) All valves through which the radioactive contents could escape must be protected against unauthorized operation.

xi) The design of the package must take into account ambient temperatures and pressures that are likely to be encountered in routine conditions of transport.

xii) A package must be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum radioactive contents that the package is designed to contain, the dose rate at any point on the external surface of the package would not exceed the values specified, as applicable.

2) ADDITIONAL REQUIREMENTS FOR PACKAGES TRANSPORTED BY AIR

i. The temperature of the accessible surfaces must not exceed 50°C at an ambient temperature of 38°C with no account taken of insolation.

ii. Packages must be designed so that, if they were exposed to ambient temperatures ranging from –40°C to +55°C, the integrity of the containment would not be impaired.

iii. Packages containing radioactive material must be capable of withstanding, without loss or dispersal of radioactive contents from the containment system, an internal pressure that produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.

3) REQUIREMENTS FOR EXCEPTED PACKAGES

An excepted package must be designed to meet the requirements specified and, in addition, the additional requirements if it contains fissile material allowed by one of the provisions specified.

4) REQUIREMENTS FOR INDUSTRIAL PACKAGES

a) Industrial packages Types 1, 2 and 3 (Types IP-1, IP-2 and IP-3) must meet the requirements specified in section 1, 2 and 5.

b) A Type IP-2 package must, if it were subjected to the tests specified in section 14 prevent:

i) loss or dispersal of the radioactive contents; and

ii) more than a 20 per cent increase in the maximum dose rate at any external surface of the package.

c)A Type IP-3 package must meet all the requirements specified in section 6

d) Alternative requirements for industrial packages Types 2 and 3 (Types IP-2 and IP-3)

i) Packages may be used as a Type IP-2 package, provided that

- they satisfy the requirements;
- they are designed to satisfy the requirements prescribed for Packing Group I or II in Part 6, Chapters 1 to 4, of these standards; and
- when subjected to the tests required for Packing Group I or II in Part 6, Chapter 4, they would prevent:

- loss or dispersal of the radioactive contents; and
- more than a 20 per cent increase in the maximum dose rate at any external surface of the package.

ii) Freight containers with the characteristics of a permanent enclosure may also be used as Industrial package Type 2 or 3 (Type IP-2 or IP-3), provided that:

- the radioactive contents are restricted to solid materials;
- they satisfy the requirements; and
- they are designed to conform to ISO 1496-1:1990: "Series 1 freight containers – Specification and testing – Part 1: General cargo containers" and subsequent amendments 1:1993, 2:1998, 3:2005, 4:2006 and 5:2006, excluding dimensions and ratings. They must be designed so that, if subjected to the tests prescribed in that document and to the accelerations occurring during routine conditions of transport, they would prevent:

- loss or dispersal of the radioactive contents; and
- ii) more than a 20 per cent increase in the maximum dose rate at any external surface of the freight containers.

5) REQUIREMENTS FOR PACKAGES CONTAINING URANIUM HEXAFLUORIDE

a) Packages designed to contain uranium hexafluoride must meet the requirements which pertain to the radioactive and fissile properties of the material prescribed elsewhere in these standards. Except as allowed, uranium hexafluoride in quantities of 0.1 kg or more must also be packaged and transported in accordance with the provisions of ISO 7195:2005: "Nuclear Energy – Packaging of uranium hexafluoride (UF6) for transport", and the requirements specified. The package must also meet the requirements prescribed elsewhere in these standards, which pertain to the radioactive and fissile properties of the material.

b) Each package designed to contain 0.1 kg or more of uranium hexafluoride must be designed so that the package would meet the following requirements:

i) to international or national standards other than ISO 7195:2005 provided an equivalent level of safety is maintained; and/or

ii) to withstand, without leakage and without unacceptable stress, a test pressure of less than 2.76 MPa, as specified; and/or

iii) to contain 9 000 kg or more of uranium hexafluoride and the packages do not meet the requirement of as specified. In all other respects, the requirements specified must be satisfied.

6) REQUIREMENTS FOR TYPE A PACKAGES

a) Type A packages must be designed to meet the requirements specified.

b) The smallest overall external dimension of the package must not be less than 10 cm.

c) The outside of the package must incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that it has not been opened.

d) Any tie-down attachments on the package must be designed so that, under normal and accident conditions of transport, the forces in those attachments must not impair the ability of the package to meet the requirements of these standards.

e) The design of the package must take into account temperatures ranging from –40°C to +70°C for the components of the packaging. Attention must be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.

f) The design and manufacturing techniques must be in accordance with national or international standards, or other requirements, acceptable to the competent authority.

g) The design must include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise within the package.

h) Special form radioactive material may be considered as a component of the containment system.

i) If the containment system forms a separate unit of the package, the containment system must be capable of being securely closed by a positive fastening device which is independent of any other part of the packaging.

j) The design of any component of the containment system must take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.

k) The containment system must retain its radioactive contents under a reduction of ambient pressure to 60 kPa.

l) All valves, other than pressure relief valves, must be provided with an enclosure to retain any leakage from the valve.

m) A radiation shield, which encloses a component of the package specified as a part of the containment system, must be designed so as to prevent the unintentional release of that component from the shield. Where the radiation shield and such component within it form a separate unit, the radiation shield must be capable of being securely closed by a positive fastening device, which is independent of any other packaging structure.

n) A package must be designed so that if it were subjected to the tests specified, it would prevent:

i) loss or dispersal of the radioactive contents; and

ii) more than a 20 per cent increase in the maximum dose rate at any external surface of the package.

o) The design of a package intended for liquid radioactive material must make provision for ullage to accommodate variations in the temperature of the contents, dynamic effects and filling dynamics.

p) Type A packages to contain liquids

A Type A package designed to contain liquid radioactive material must, in addition:

i) be adequate to meet the conditions specified, if the package is subjected to the tests specified; and

ii) either:

- be provided with sufficient absorbent material to absorb twice the volume of the liquid contents. Such absorbent material must be suitably positioned so as to contact the liquid in the event of leakage; or

- be provided with a containment system composed of primary inner and secondary outer containment components, designed to enclose the liquid contents completely and ensure their retention within the secondary outer containment components, even if the primary inner components leak.

q) Type A packages to contain gas

A Type A package designed for gases must prevent loss or dispersal of the radioactive contents if the package were subjected to the tests specified, except for a Type A package designed for tritium gas or for noble gases.

7) REQUIREMENTS FOR TYPE B(U) PACKAGES

a) Type B(U) packages must be designed to meet the requirements specified.

b) A package must be designed so that, under the ambient conditions specified, heat generated within the package by the radioactive contents does not, under normal conditions of transport, as demonstrated by the tests required, adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for a period of one week. Particular attention must be paid to the effects of heat, which may cause one or more of the following:

i) alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt;

ii) lessening of the efficiency of the packaging through differential thermal expansion or cracking or melting of the radiation shielding material;

iii) in combination with moisture, accelerate corrosion.

c) A package must be so designed that, under the ambient condition specified and in the absence of isolation, the temperature of the accessible surfaces of a package must not exceed 50°C, unless the package is transported under exclusive use.

d) In order to meet the requirements, account may be taken of barriers or screens intended to give protection to persons without the need for the barriers or screens being subject to any test.

e) The ambient temperature must be assumed to be 38°C.

f) The solar insolation conditions must be assumed to be as specified in Table 6-5.

g) A package which includes thermal protection for the purpose of satisfying the requirements of the thermal test specified must be so designed that such protection will remain effective if the package is subjected to the tests specified, as appropriate. Any such protection on the exterior of the package must not be rendered ineffective by ripping, cutting, skidding, abrasion or rough handling.

g) A package must be so designed that, if it were subjected to:

i) the tests specified, it would restrict the loss of radioactive contents to not more than 10–6 A2 per hour; and

ii) the tests specified and either the tests in:

- when the package has a mass not greater than 500 kg, an overall density not greater than 1 000 kg/m3 based on the external dimensions, and radioactive contents greater than 1 000 A2 not as special form radioactive material; or

- for all other packages, it would meet the following requirements:

— retain sufficient shielding to ensure that the dose rate at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and

— restrict the accumulated loss of radioactive contents in a period of one week to not more than 10 A2 for krypton-85 and not more than A2 for all other radionuclides.

Where mixtures of different radionuclides are present, the provisions must apply except that for krypton-85, an effective A2(i) value equal to 10 A2 may be used. For case a) above, the assessment must take into account the external non-fixed contamination limits.

Table 6-5. Insolation data

Case	*Form and location of surface*	*Insolation for 12 hours per day (W/m^2)*
1	Flat surfaces transported horizontally – downward facing	0
2	Flat surfaces transported horizontally – upward facing	800
3	Surfaces transported vertically	200*
4	Other downward facing (not horizontal) surfaces	200*
5	All other surfaces	400*

* Alternatively, a sine function may be used, with an absorption coefficient adopted and the effects of possible reflection from neighbouring objects neglected.

h) A package for radioactive contents with activity greater than 105 A2 must be designed so that if it were subjected to the enhanced water immersion test specified in 7.17, there would be no rupture of the containment system.

i) Compliance with the permitted activity release limits must depend neither upon filters nor upon a mechanical cooling system.

j) A package must not include a pressure relief system from the containment system, which would allow the release of radioactive material to the environment under the conditions of the tests specified.

k) A package must be designed so that if it were at the maximum normal operating pressure and it were subjected to the tests specified, the level of strains in the containment system would not attain

values which would adversely affect the package in such a way that it would fail to meet the applicable requirements.

l) A package must not have a maximum normal operating pressure in excess of a gauge pressure of 700 kPa.

m) A package containing low dispersible radioactive material must be so designed so that any features added to the low dispersible radioactive material that are not part of it, or any internal components of the packaging must not adversely affect the performance of the low dispersible radioactive material.

n) A package must be designed for an ambient temperature range from –40°C to +38°C.

8) REQUIREMENTS FOR TYPE B(M) PACKAGES

Type B(M) packages must meet the requirements for Type B(U) packages specified.

9) REQUIREMENTS FOR TYPE C PACKAGES

a) Type C packages must be designed to meet the requirements specified.

b) A package must be capable of meeting the assessment criteria prescribed after burial in an environment defined by a thermal conductivity of 0.33 W/(m.K) and a temperature of 38°C in the steady state. Initial conditions for the assessment must assume that any thermal insulation of the package remains intact, the package is at the maximum normal operating pressure and the ambient temperature is 38°C.

c) A package must be designed so that, if it were at the maximum normal operating pressure and subjected to:

i) the tests specified, it would restrict the loss of radioactive contents to not more than 10–6 A2 per hour; and

ii) the test sequences specified, it would:

iii) retain sufficient shielding to ensure that the dose rate at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and restrict the accumulated loss of radioactive contents in a period of one week to not more than 10 A2 for krypton-85 and not more than A2 for all other radionuclides.

Where mixtures of different radionuclides are present, the applicable provisions must apply, except that for krypton-85 an effective A2(i) value equal to 10 A2 may be used. For case a) above, the assessment must take into account the external contamination limits.

d)A package must be so designed that there will be no rupture of the containment system following performance of the enhanced water immersion test specified.

10) REQUIREMENTS FOR PACKAGES CONTAINING FISSILE MATERIAL

a) Fissile material must be transported so as to:

i) maintain subcriticality during routine, normal and accident conditions of transport; in particular, the following contingencies must be considered:

- water leaking into or out of packages;
- the loss of efficiency of built-in neutron absorbers or moderators;
- rearrangement of the contents either within the package or as a result of loss from the package;
    - reduction of spaces within or between packages;
    - packages becoming immersed in water or buried in snow; and
    - temperature changes; and

ii)meet the requirements:

- prescribed elsewhere in these standards and which pertain to the radioactive properties of the material;

unless the material is excepted

unless the material is excepted.

iii)below are excepted from the requirements specified.

iv) Packages containing fissile material in any form provided that:

- the smallest external dimension of the package is not less than 10 cm;
- the criticality safety index of the package is calculated using the following formula:
- the criticality safety index of any package does not exceed 10

v) packages containing fissile material in any form provided that:

- the smallest external dimension of the package is not less than 10 cm;
- the package, after being subjected to the tests specified:

— retains its fissile material contents;
— preserves the minimum overall outside dimensions of the package to at least 10 cm;
— prevents the entry of a 10 cm cube;

vi) the total mass of beryllium, hydrogenous material enriched in deuterium, graphite and other allotropic forms of carbon in an individual package must not be greater than the mass of fissile nuclides in the package except where the total concentration of these materials does not exceed 1 g in any 1 000 g of material. Beryllium incorporated in copper alloys up to 4 per cent in weight of the alloy does not need to be considered

Table 6-6. Values of Z for calculation of criticality safety index in accordance with 7.10.b

Enrichment[a]*	*Z*
Uranium enriched up to 1.5%	2 200
Uranium enriched up to 5%	850
Uranium enriched up to 10%	660
Uranium enriched up to 20%	580
Uranium enriched up to 100%	450

* If a package contains uranium with varying enrichments of U-235, then the value corresponding to the highest enrichment must be used for Z.

c) Packages containing not more than 1 000 g of plutonium are excepted from the application provided that:

i) not more than 20 per cent of the plutonium by mass is fissile nuclides;

i) the criticality safety index of the package is calculated using the following formula:

CSI=50x2x (Mass of plutonium (g)1 000)

if uranium is present with the plutonium, the mass of uranium must be no more than 1 per cent of the mass of the plutonium.

d) Where the chemical or physical form, isotopic composition, mass or concentration, moderation ratio or density, or geometric configuration is not known, the assessments specified must be performed assuming that each parameter that is not known has the value which gives the maximum neutron multiplication consistent with the known conditions and parameters in these assessments.

e) For irradiated nuclear fuel the assessments specified. I must be based on an isotopic composition demonstrated to provide:

i) the maximum neutron multiplication during the irradiation history; or

ii) a conservative estimate of the neutron multiplication for the package assessments. After irradiation but prior to shipment, a measurement must be performed to confirm the conservatism of the isotopic composition.

f) The package, after being subjected to the tests specified, must:

i) preserve the minimum overall outside dimensions of the package to at least 10 cm; and

ii) prevent the entry of a 10-cm cube.

g) The package must be designed for an ambient temperature range of –40°C to +38°C unless the competent authority specifies otherwise in the certificate of approval for the package design.

h) For a package in isolation, it must be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features must include either of the following:

i) multiple high standard water barriers not less than two of which would remain watertight if the package were subject to the tests prescribed, a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment; or

ii) for packages containing uranium hexafluoride only, with maximum enrichment of 5 mass per cent uranium-235:

- packages where, following the tests prescribed, there is no physical contact between the valve or the plug and any other component of the packaging other than at its original point of attachment and where, in addition, following the test prescribed, the valves and the plug remain leaktight; and
- a high degree of quality control in the manufacture, maintenance and repair of packagings coupled with tests to demonstrate closure of each package before each shipment.

i) It must be assumed that the confinement system is closely reflected by at least 20 cm of water or such greater reflection as may additionally be provided by the surrounding material of the packaging. However, when it can be demonstrated that the confinement system remains within the packaging following the tests prescribed, close reflection of the package by at least 20 cm of water may be assumed.

j) The package must be subcritical under the required conditions, with the package conditions that result in the maximum neutron multiplication consistent with:

I) routine conditions of transport (incident free);

II) the relevant tests specified;

III)the relevant tests specified.

i) The package must be subcritical under conditions consistent with the Type C package tests specified assuming reflection by at least 20 cm of water but no water-in leakage.

ii) In the assessment of use of special features as specified provided that leakage of water into or out of the void spaces is prevented when the package is submitted to the Type C package tests specified followed by the water leakage test specified.

iii) A number “N” must be derived, such that five times “N” must be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

- There must not be anything between the packages, and the package arrangement must be reflected on all sides by at least 20 cm of water; and
- The state of the packages must be their assessed or demonstrated condition if they had been subjected to the tests specified.

l) A number “N” must be derived, such that two times “N” must be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:

i) hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water; and

ii) the tests specified followed by whichever of the following is the more limiting:

- the tests specified and, either for packages having a mass not greater than 500 kg and an overall density not greater than 1 000 kg/m3 based on the external dimensions, or for all other packages; followed by the test specified and completed by the tests specified; or
- the test specified; and

iii)where any part of the fissile material escapes from the containment system following the tests specified in 7.10.m (ii), it must be assumed that fissile material escapes from each package in the array and all of the fissile material must be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.

m) The criticality safety index (CSI) for packages containing fissile material must be obtained by dividing the number 50 by the smaller of the two values of N derived in 7.10.l and 7.10.m (that is, CSI = 50/N). The value of the CSI may be zero, provided that an unlimited number of packages is subcritical (that is, N is effectively equal to infinity in both cases).

11) TEST PROCEDURES AND DEMONSTRATION OF COMPLIANCE

a) Demonstration of compliance with the performance standards required must be accomplished by any of the methods listed below or by a combination thereof:

i) Performance of tests with specimens representing special form radioactive material, or low dispersible radioactive material or with prototypes or samples of the packaging, where the contents of

the specimen or the packaging for the tests must simulate, as closely as practicable, the expected range of radioactive contents and the specimen or packaging to be tested must be prepared as presented for transport;

ii) Reference to previous satisfactory demonstrations of a sufficiently similar nature;

iii) Performance of tests with models of appropriate scale incorporating those features which are significant with respect to the item under investigation when engineering experience has shown results of such tests to be suitable for design purposes. When a scale model is used, the need for adjusting certain test parameters, such as penetrator diameter or compressive load, must be taken into account;

iv)Calculation, or reasoned argument, when the calculation procedures and parameters are generally agreed to be reliable or conservative

b) After the specimen, prototype or sample has been subjected to the tests, appropriate methods of assessment must be used to assure that the requirements for the test procedures have been fulfilled in compliance with the performance and acceptance standards
c) All specimens must be inspected before testing in order to identify and record faults or damage including the following:

I) divergence from the design;
II) defects in manufacture;
III) corrosion or other deterioration; and
IV) distortion of features.

The containment system of the package must be clearly specified. The external features of the specimen must be clearly identified so that reference may be made simply and clearly to any part of such a specimen.

12) TESTING THE INTEGRITY OF THE CONTAINMENT SYSTEM AND SHIELDING AND EVALUATING CRITICALITY SAFETY

After each test or group of tests or sequence of the applicable tests, as appropriate, specified:

a) faults and damages must be identified and recorded;

b) it must be determined whether the integrity of the containment system and shielding has been retained to the extent required for the package under test; and

c) it must be determined, for packages containing fissile material, whether the assumptions and conditions used in the assessments required for one or more packages are valid.

13) TARGET FOR DROP TESTS

The target for the drop tests specified must be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

14) TESTS FOR DEMONSTRATING ABILITY TO WITHSTAND NORMAL CONDITIONS OF TRANSPORT

a) The tests are: the water spray test, the free drop test, the stacking test and the penetration test. Specimens of the package must be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements are fulfilled.

b) The time interval between the conclusion of the water spray test and the succeeding test must be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval must be taken to be two hours if the water spray is applied from four directions simultaneously. No time interval must elapse, however, if the water spray is applied from each of the four directions consecutively.

c) Water spray test: the specimen must be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour.

d) Free drop test: the specimen must drop onto the target so as to suffer maximum damage in respect of the safety features to be tested.

i) The height of the drop, measured from the lowest point of the specimen to the upper surface of the target, must be not less than the distance specified in Table 6-7 for the applicable mass. The target must be as defined;

ii) For rectangular fibreboard or wood packages not exceeding a mass of 50 kg, a separate specimen must be subjected to a free drop onto each corner from a height of 0.3 m;

iii)For cylindrical fibreboard packages not exceeding a mass of 100 kg, a separate specimen must be subjected to a free drop onto each of the quarters of each rim from a height of 0.3 m.

Table 6-7. Free drop distance for testing packages to normal conditions of transport

Package mass (kg)	*Free drop distance (m)*
Package mass < 5 000	1.2
5 000 ≤ Package mass < 10 000	0.9
	0.6

10 000 ≤ Package mass < 15 000 15 000 ≤ Package mass	0.3

e) Stacking test: unless the shape of the packaging effectively prevents stacking, the specimen must be subjected, for a period of 24 hours, to a compressive load equal to the greater of the following:

i) the equivalent of five times the maximum weight of the package; and

ii) the equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load must be applied uniformly to two opposite sides of the specimen, one of which must be the base on which the package would typically rest.

f) Penetration test: the specimen must be placed on a rigid, flat, horizontal surface which will not move significantly while the test is being carried out.

i) A bar of 3.2 cm in diameter with a hemispherical end and a mass of 6 kg must be dropped and directed to fall, with its longitudinal axis vertical, onto the centre of the weakest part of the specimen so that, if it penetrates sufficiently far, it will hit the containment system. The bar must not be significantly deformed by the test performance;

ii) The height of the drop of the bar, measured from its lower end to the intended point of impact on the upper surface of the specimen, must be 1 m.

15) ADDITIONAL TESTS FOR TYPE A PACKAGES DESIGNED FOR LIQUIDS AND GASES

A specimen or separate specimens must be subjected to each of the following tests, unless it can be demonstrated that one test is more severe for the specimen in question than the other, in which case one specimen must be subjected to the more severe test.

a) Free drop test: the specimen must drop onto the target so as to suffer the maximum damage in respect of containment. The height of the drop measured from the lowest part of the specimen to the upper surface of the target must be 9 m. The target must be as defined;

b) Penetration test: the specimen must be subjected to the test specified except that the height of the drop must be increased to 1.7 m from the 1 m specified.

16) TESTS FOR DEMONSTRATING THE ABILITY TO WITHSTAND ACCIDENT CONDITIONS IN TRANSPORT

a) The specimen must be subjected to the cumulative effects of the tests. Following these tests, either this specimen or a separate specimen must be subjected to the effect(s) of the water immersion test(s) as specified and, if applicable.

b) Mechanical test: the mechanical test consists of three different drop tests. Each specimen must be subjected to the applicable drops as specified in 7.7.h or 7.10.m. The order in which the specimen is subjected to the drops must be such that, on completion of the mechanical test, the specimen must have suffered such damage as will lead to the maximum damage in the thermal test which follows:

i) For drop I, the specimen must drop onto the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target must be 9 m. The target must be as defined;

ii) For drop II, the specimen must drop onto a bar rigidly mounted perpendicularly on the target so as to suffer the maximum damage. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar must be 1 m. The bar must be of solid mild steel of circular cross-section, (15.0 ± 0.5 cm) in diameter and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage must be used. The upper end of the bar must be flat and horizontal with its edge rounded off to a radius of not more than 6 mm. The target on which the bar is mounted must be as described;

iii)For drop III, the specimen must be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 m onto the specimen. The mass must consist of a solid mild steel plate 1 m by 1 m and must fall in a horizontal attitude. The lower face of the steel plate must have its edges and corners rounded off to a radius of not more than 6 mm. The height of the drop must be measured from the underside of the plate to the highest point of the specimen. The target on which the specimen rests must be as defined.

c) Thermal test: the specimen must be in thermal equilibrium under conditions of an ambient temperature of 38°C, subject to the solar insolation conditions specified in Table 6-5 and subject to the design maximum rate of internal heat generation within the package from the radioactive contents. Alternatively, any of these parameters are allowed to have different values prior to and during the test, provided due account is taken of them in the subsequent assessment of package response. The thermal test must then consist of:

i) exposure of a specimen for a period of 30 minutes to a thermal environment which provides a heat flux at least equivalent to that of a hydrocarbon fuel/air fire in sufficiently quiescent ambient conditions to give a minimum average flame emissivity coefficient of 0.9 and an average temperature of at least 800°C, fully engulfing the specimen, with a surface absorptivity coefficient of 0.8 or that value which the package may be demonstrated to possess if exposed to the fire specified, followed by;

ii) exposure of the specimen to an ambient temperature of 38°C, subject to the solar insolation conditions specified in Table 6-5 and subject to the design maximum rate of internal heat generation within the package by the radioactive contents for a sufficient period to ensure that temperatures in the specimen are decreasing in all parts of the specimen and/or are approaching initial steady-state conditions. Alternatively, any of these parameters are allowed to have different values following

cessation of heating, provided due account is taken of them in the subsequent assessment of package response.

During and following the test, the specimen must not be artificially cooled and any combustion of materials of the specimen must be permitted to proceed naturally.

d) Water immersion test: the specimen must be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa must be considered to meet these conditions.

17) ENHANCED WATER IMMERSION TEST FOR TYPE B(U) AND TYPE B(M) PACKAGES CONTAINING MORE THAN 105 A2, AND TYPE C PACKAGES

Enhanced water immersion test: the specimen must be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa must be considered to meet these conditions

18) WATER LEAKAGE TEST FOR PACKAGES CONTAINING FISSILE MATERIAL

a) Packages for which water in-leakage or out-leakage to the extent which results in the greatest reactivity has been assumed, must be excepted from the test.

b) Before the specimen is subjected to the water leakage test specified below, it must be subjected to additional test as specified.

c) The specimen must be immersed under a head of water of at least 0.9 m for a period of not less than eight hours and in the attitude for which maximum leakage is expected.

19) TESTS FOR TYPE C PACKAGES

a) Puncture/tearing test: the specimen must be subjected to the damaging effects of a vertical solid probe made of mild steel. The orientation of the package specimen and the impact point on the package surface must be such as to cause maximum damage at the conclusion of the test sequence specified.

i) The specimen, representing a package having a mass less than 250 kg, must be placed on a target and subjected to a probe having a mass of 250 kg and falling from a height of 3 m above the intended impact point. For this test, the probe must be a 20 cm in diameter cylindrical bar with the striking end forming a frustum of a right circular cone with the following dimensions: 30 cm in height and 2.5 cm in

diameter at the top with its edge rounded off to a radius of not more than 6 mm. The target on which the specimen is placed must be as specified;

ii) For packages having a mass of 250 kg or more, the base of the probe must be placed on a target and the specimen dropped onto the probe. The height of the drop, measured from the point of impact with the specimen to the upper surface of the probe must be 3 m. For this test, the probe must have the same properties and dimensions as specified in a) above, except that the length and mass of the probe must be such as to incur maximum damage to the specimen. The target on which the base of the probe is placed must be as specified.

b) Enhanced thermal test: the conditions for this test must be as specified, except that the exposure to the thermal environment must be for a period of 60 minutes.

c) Impact test: the specimen must be subject to an impact on a target at a velocity of not less than 90 m/s, at such an orientation as to suffer maximum damage. The target must be as defined, except that the target surface may be at any orientation as long as the surface is normal to the specimen path.

20) TESTS FOR PACKAGINGS DESIGNED TO CONTAIN URANIUM HEXAFLUORIDE

Specimens that comprise or simulate packagings designed to contain 0.1 kg or more of uranium hexafluoride must be tested hydraulically at an internal pressure of at least 1.38 MPa but, when the test pressure is less than 2.76 MPa, the design must require multilateral approval. For re-testing packagings, any other equivalent non-destructive testing may be applied subject to multilateral approval.

21) APPROVALS OF PACKAGE DESIGNS AND MATERIALS

a) The approval of designs for packages containing 0.1 kg or more of uranium hexafluoride requires that:

i) each design that meets the requirements requires multilateral approval;

ii) each design that meets the requirements must require unilateral approval by the competent authority of the State of Origin of the design, unless multilateral approval is otherwise required by these standards.

b) Each Type B(U) and Type C package design requires unilateral approval, except that:

i) a package design for fissile material, which require multilateral approval; and

ii) a Type B(U) package design for low dispersible radioactive material must require multilateral approval.

c) Each Type B(M) package design, and those for low dispersible radioactive material, must require multilateral approval.

d) Each package design for fissile material which is not excepted by any of the paragraphs in Segment 2;7. must require multilateral approval.

e) The design for special form radioactive material must require unilateral approval. The design for low dispersible radioactive material must require multilateral approval (see also 6.4.23.8 of the UN Recommendations).

f) The design for a fissile material excepted from fissile classification in accordance with Segment 2;7 must require multilateral approval.

g) Alternative activity limits for an exempt consignment of instruments or articles in accordance with Segment 2;7 must require multilateral approval.

22) APPLICATIONS AND APPROVALS FOR RADIOACTIVE MATERIAL TRANSPORT

See 6.4.23 the UN Model Regulations.

23) REGISTRATION OF SERIAL NUMBERS AND VALIDATION

a) The competent authority must be informed of the serial number of each packaging manufactured to a design approved by them. The competent authority must maintain a register of such numbers.

b) Multilateral approval may be by validation of the original certificate issued by the competent authority of the State of Origin of the design or shipment.

24) TRANSITIONAL MEASURES FOR CLASS 7

a) Packages not requiring competent authority approval of design under the 1985, 1985 (As Amended 1990),1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material

Packages not requiring competent authority approval of design (excepted packages, Type IP-1, Type IP-2, Type IP-3 and Type A packages) must meet these standards in full, except that:

i) packages that meet the requirements of the 1985 or 1985 (As Amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material:

- may continue in transport provided that they were prepared for transport prior to 31 December 2003, and are subject to the requirements of 6.4.24.4 of the UN Model Regulations, if applicable;
- may continue to be used, provided that all of the following conditions are met:

1) they were not designed to contain uranium hexafluoride;
2) the applicable requirements of 1;6.3 of these standards s are applied;
3) the activity limits and classification in Segment 2;7 of these Technical standards are applied;
4) the requirements and controls for transport of these Technical standards are applied;
5) the packaging was not manufactured or modified after 31 December 2003.

ii) packages that meet the requirements of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material:

- may continue in transport provided that they were prepared for transport prior to 31 December 2025 and are subject to the requirements of 6.4.24.4 of the UN Model Regulations, if applicable; or
- may continue to be used, provided that all the following conditions are met:

1) the applicable requirements of Segment 1;6.3 of these standards are applied;
2) the activity limits and classification in Segment 2;7 of these standards are applied;
3) the requirements and controls for transport in these Technical Standards are applied; and
4) the packaging was not manufactured or modified after 31 December 2025.

b) Package designs approved under the 1985, 1985 (As amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material

- Packages requiring competent authority approval of the design must meet these standards in full except that:

i) packagings that were manufactured to a package design approved by the competent authority under the provisions of the 1985 or 1985 (As Amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used provided that all of the following conditions are met:

- ✓ the package design is subject to multilateral approval;
- ✓ the applicable requirements of 1;6.3 of these standards are applied;
- ✓ the activity limits and classification in Part 2;7 of these standards s are applied;
- ✓ the requirements and controls for transport in in Parts 1, 3, 4, 5 and 7 of these standards are applied;
- ✓ for a package containing fissile material and transported by air, the requirement of 7.10.k is met;

ii) packagings that were manufactured to a package design approved by the competent authority under the provisions of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used provided that all of the following conditions are met:

- ✓ the package design is subject to multilateral approval after 31 December 2025;
- ✓ the applicable requirements of 1;6.3 of these standards are applied;

- ✓ the activity limits and material restrictions of section of these standards are applied;
- ✓ the requirements and controls for transport in section 1, 3, 4, 5 and 7 of these standards are applied.

iii) No new manufacture of packagings to a package design meeting the provisions of the 1985 and 1985 (as amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material is permitted to commence.

iv)No new manufacture of packagings of a package design meeting the provisions of the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 or 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material is permitted to commence after 31 December 2028.

c) Special form radioactive material approved under the 1985, 1985 (as amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material

Special form radioactive material manufactured to a design which had received unilateral approval by the competent authority under the 1985, 1985 (As Amended 1990), 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material may continue to be used when in compliance with the mandatory management system in accordance with the applicable requirements of 1;6.3. There must be no new manufacture of special form radioactive material to a design that had received unilateral approval by the competent authority under the 1985 or 1985 (As amended 1990) editions of the IAEA Regulations for the Safe Transport of Radioactive Material. No new manufacture of special form radioactive material to a design that had received unilateral approval by the competent authority under the 1996, 1996 (revised), 1996 (as amended 2003), 2005, 2009 and 2012 editions of the IAEA Regulations for the Safe Transport of Radioactive Material is permitted to commence after 31 December 2025.

7. REQUIREMENTS FOR INTERMEDIATE BULK CONTAINERS

1) MARKING OF PACKAGING FOR INTERMEDIATE BULK CONTAINERS

a) Intermediate bulk containers, which meet the requirements of the UN Recommendations, must be marked with a packaging mark.

b) The packaging mark consists of:

i) the United Nations packaging symbol

For metal IBCs on which the mark is stamped or embossed, the capital letters “UN” may be applied instead of the symbol;

ii) the code designating the type of IBC as shown in Packing Instruction 956 and as described in detail in Chapter 6.5 of the UN Model Recommendations;

iii) a capital letter designating the packing group(s) for which the design type has been approved:

- ✓ X for Packing Groups I, II and III;
- ✓ Y for Packing Groups II and III;
- ✓ Z for Packing Group III only;

iv) the month and year (last two digits) of manufacture;

v)the State authorizing the allocation of the mark; indicated by the distinguishing sign used on vehicles in international road traffic;

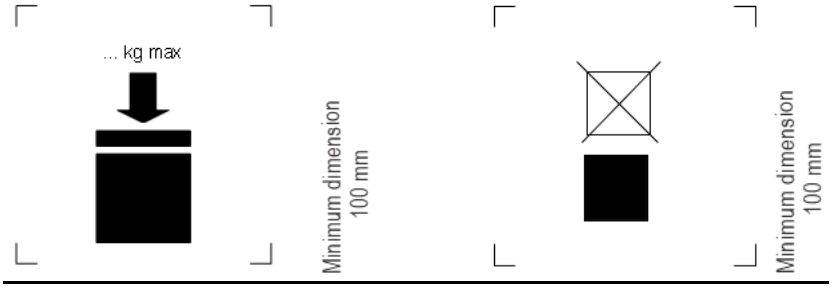
Note.— The distinguishing sign used on vehicles in international road traffic is the distinguishing sign of the State of registration used on motor vehicles and trailers in international road traffic, such as in accordance with the Geneva Convention on Road Traffic of 1949 or the Vienna Convention on Road Traffic of 1968.

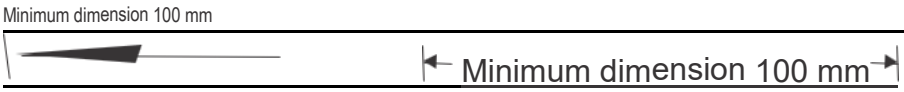
vi) the name or symbol of the manufacturer and other identification of the IBC, as specified by the appropriate national authority;

vii) the stacking test load in kg. For IBCs not designed for stacking, the figure “0” must be shown;

viii) the maximum permissible gross mass in kg.

c)The maximum permitted stacking load applicable when the IBC is in use must be displayed on a symbol as shown in Figure 6-2 or Figure 6-3. The symbol must be durable and clearly visible.





The minimum dimensions must be 100 mm x 100 mm. The letters and numbers indicating the mass must be at least 12 mm high. The area within the printer's marks indicated by the dimensional arrows must be square. Where dimensions are not specified, all features must be in approximate proportion to those shown. The mass marked above the symbol must not exceed the load imposed during the design type test (see 6.5.6.6.4 of the UN Model Regulations) divided by 1.8.

Note.— The provisions of © apply to all IBCs manufactured, repaired or remanufactured as from 1 January 2011.

d) Example of a mark is:

13H3/Z/03 01 as in as in (b) I to iii), and d) F/Meunier1713/0/1000 as in b iv to viii)